

From solid form to wire

By Nidasio Michelangelo*



When Ilario PROPERZI began a new company in 1947 to exploit his ideas and patents relative to machinery and methods for continuous casting and rolling of nonferrous metals, he had to decide upon a fitting company name for introduction into the international market. Not being an egotistical person, his own family name of PROPERZI was not even a consideration. As he was greatly influenced by classical literature, he chose the Latin word "CONTINUUS". During the years, and especially in the international English speaking market, this new revolutionary metallurgical process, a continuous casting system to produce rod and wire, for "lead, zinc and then aluminium" was called the PROPERZI process. Therefore, the actual name of the company is a combination of the type of process, CONTINUUS and the family name of the inventor, PROPERZI. Today, the company CONTINUUS PROPERZI is synonymous worldwide with who invented the continuous casting into a wheel and direct rolling of the emerging bar through a rolling mill with stands having three (3) rolls. In the early days of the company, the first material processed was lead and subsequently zinc (increasing the temperature of the liquid metal). But the real success and the definitive notoriety regarding this new process for the continuous production of wire rod, and consequent affirmation of the company

and proclamation of the name PROPERZI as PROPERZI TECHNOLOGY or PROPERZI CASTING, took place with aluminium. By the 1950s, all the largest producers of wire rod in the world embraced the PROPERZI technology, enhancing its name. Once the aluminium process was well consolidated, only the noblest COPPER remained. The development with the copper process began in the early 1960s and was consolidated in the 1970s. Practically starting from the very simple Continuous casting line and rolling mill (Line N°1 is on display at the Science & Technology Museum in Milan) we supply complete solutions for melting solids to obtain wire.

During the last 75+ years of CONTINUUS PROPERZI's history, the market required that the simple but effective CCR Line be upgraded and expanded, from time to time, to better satisfy the additional, and increasingly sophisticated, needs of the market.

To ensure a sound and correct cast bar in terms of chemistry & metallurgy, specific melting systems have been developed for both Copper and Aluminium.

- Shaft and holding furnaces for copper cathodes
- Refining Furnaces for FRHC (Fire Refined High Conductivity) copper from scrap $\geq 93\%$ Cu content (green copper resurrecting scrap)
- Vert-Ref for high quality FRHC copper from scrap $\geq 97\%$ Cu content

(green copper resurrecting scrap)

- Vert-Melt for aluminium ingot with the lowest melting cost in energy per ton

The design and subsequent improvement of the furnaces was carried out to optimise energy efficiency for maximum exploitation of the CCR lines. Obviously, who can best achieve these results if not the builder and inventor of this technology?

Today we are in a position to be able to say that our continuous R&D efforts, coupled with our engineering and design, have allowed us to obtain excellent results recognised by all our customers around the world.

As far as the Aluminium CCR line is concerned, it has undergone considerable transformations and improvements from both metallurgical and automation perspectives. Naturally, all these improvements have been implemented while maintaining the safety of the operators and with the utmost respect for the environment through the reduction of polluting emissions.

During the last five decades, we have progressed from the simple pure Aluminium (EC Grade) to the ability to produce all the alloys in different tempers. At the very beginning it was only necessary to produce EC Grade or AA1050 – AA1350 in rod format, now we can produce AA1370 from H11 up to H16

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Modern CCR Copper Line from Furnace set to automatic coiling system

(H11 – H12 – H14 – H16) and alloys in the following families:

1XXX (1050 – 1090 – 1100 – 1120 – 1350 – 1370 etc.)

2XXX (2014 – 2017 – 2024 etc.)

3XXX (3003 – 3004 – 3103 – 3014 etc.)

4XXX (4032 – 4043 – 4047 etc.)

5XXX (5005 – 5050 – 5051 – 5052 – 5086 – 5087 – 5154 – 5183 – 5754 – 5356 – 5556 etc.)

6XXX (6056 – 6065 – 6061 – 6063 – 6082 – 6101 – 6201 etc.)

7XXX (7003 – 7075 etc.)

8XXX (8030 – 8076 – 8077 – 8176 – 8177 etc.)

The typical Aluminium Line produces 9.53mm wire rod in tight coils.

The CCR Line consists of the following major equipment:

Furnace Set: High efficiency burners and furnace designs to minimize gas consumption.

Casting Machine: automatic wheel and belt type, which converts the molten metal into a continuous solid cast bar. It is supplied complete with tundish set (horizontal pouring), manual and/or

automatic control of the liquid aluminium flow into the mould. Solid and strong bar conveyor to address the bar to downstream machines.

Automatic Rotary Bar Shear: located immediately after the bar supporting roller way of the Casting machine. It is composed by one pinch roll, the shearing heads and the roller way. It is provided to cut the bar in any convenient position between the casting machine and the mill.

Bar Straightener: to straighten the cast bar.

Bar Milling Machine: to remove the corners and top of the bar where the eutectic segregations are concentrated.

Induction Bar Heater and Bar Cooler: designed to re-heat or cool the bar in order to ensure the correct rolling temperature depending on the alloy in production.

Optical Pyrometer(s): To detect bar/rod temperature in different points of the line.

Rolling Section: generally composed of one Roughing Mill (high reduction) followed by one Finishing Mill for the production of the final diameter of 9.53mm rod (intermediate diameters like 12 – 15 – 19 – 25 – 30 are available). Different diameters can be satisfied with special round-to-round stands.

Quenching Unit: dedicated for cooling the rod and to facilitate inline heat treatment for some alloys.

Automatic Twin Reel Coiler: to produce tight coils of rod for long

transportation. The automatic twin reel coiler can be equipped with complete automatic strapping and unloading machine.

Given the large variety of alloys we have today, with the vast range of required tensile, the market was not completely satisfied by the standard machine used to produce wire. To produce some alloys in the diameter range of 2.0 – 2.5mm, the traditional drawing machine needs to divide the process in one, two or sometimes three drawing steps with intermediate annealing. Realistically, depending upon the alloy it could require from three days to a week to obtain good intermediate wire with a drawing machine.

Also in this case, Properzi's technical department, led by its leader Giulio Properzi, worked to create an extremely versatile rolling mill to process 'hard-to-draw' alloys. Therefore, in the 1990's the MICROROLLING® MILL began its history.

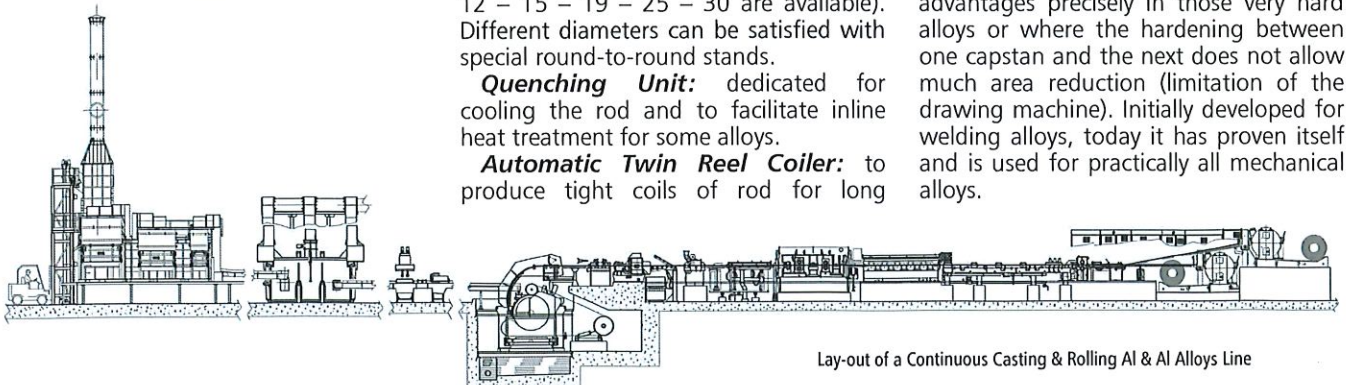
Compared to the standard breakdown drawing machine with capstans and traditional drawing dies or with roller dies, the Microrolling® mill requires a much smaller space for the break-down phase of the process.

The advantages of a Microrolling® mill over a traditional system include:

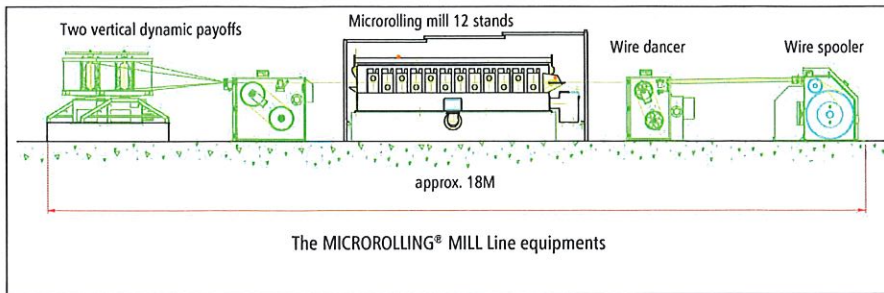
- Energy savings
- Low maintenance
- No pointing required
- Self-threading (extremely user-friendly)
- Increased safety (self-threading eliminates potential pinch points)
- Reduced work hardening of the material
- Absence of residual lubricant on wire surface
- Possibility of hot rolling without loss in output and efficiency
- Greater reduction between anneals on hard material

...All together: Lower production costs

The MICROROLLING® MILL shows all its advantages precisely in those very hard alloys or where the hardening between one capstan and the next does not allow much area reduction (limitation of the drawing machine). Initially developed for welding alloys, today it has proven itself and is used for practically all mechanical alloys.



Lay-out of a Continuous Casting & Rolling Al & Al Alloys Line

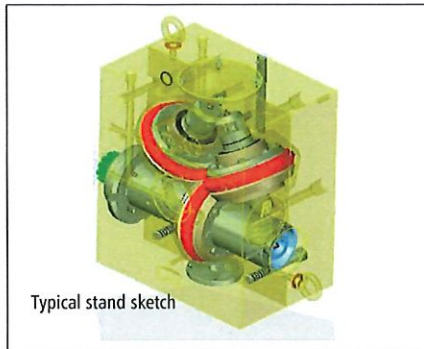


The MICROROLLING® MILL Line is composed of the following equipment:

Vertical dynamic rod pay-off: The LINE will be equipped with two (2) vertical dynamic motorized rod pay-offs to uncoil 9.53 mm aluminium rod.

Rod dancer: The rod dancer is positioned between the rod payoffs and the Microrolling® mill. The rod dancer is electrically controlled to create the appropriate tension prior to entry to the Microrolling® mill.

Microfilling® Mill: The Microrolling® mill is the heart of the plant. It is in fact the machinery which processes the raw material (aluminium alloy rod for example) from the inlet diameter down to the final diameters (2.4 – 2.6), through a sequence



Typical stand sketch

of rolling stands. The stands are located in line on the front side of the machine frame. Each stand includes two “shells” (semi

housings) containing the primary shaft which is connected to the gear train directly through a toothed coupling and appropriate shear pin. The primary shaft supports one working roll and two bevel gears, which in turn drive the other two working rolls placed at 120°.

Wire dancer

The wire dancer is positioned between the Microrolling® mill and the dynamic spooler. It is designed to absorb the differences in speed during ramp up and ramp down and to synchronise the speed during operation of the linked equipment.

Dynamic spooler

The dynamic spooler is positioned immediately after the wire dancer. The standard spooler is designed to accept reels with flange diameter of 1000 mm. The dynamic spooler is designed to collect approximately 700kg of (aluminium) wire.

Therefore, when it comes to innovation and technology for the production of wire rod and for further processing of difficult alloys, our 75+ year history affirms Continuous Properzi’s global leadership in the industry. ■

INNOVATIVE FURNACES FOR ALUMINIUM



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■ Extrusion Plants

■ Casthouses

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