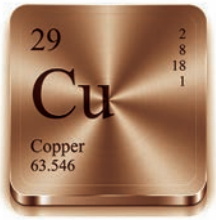
Yesterday, Today and Tomorrow

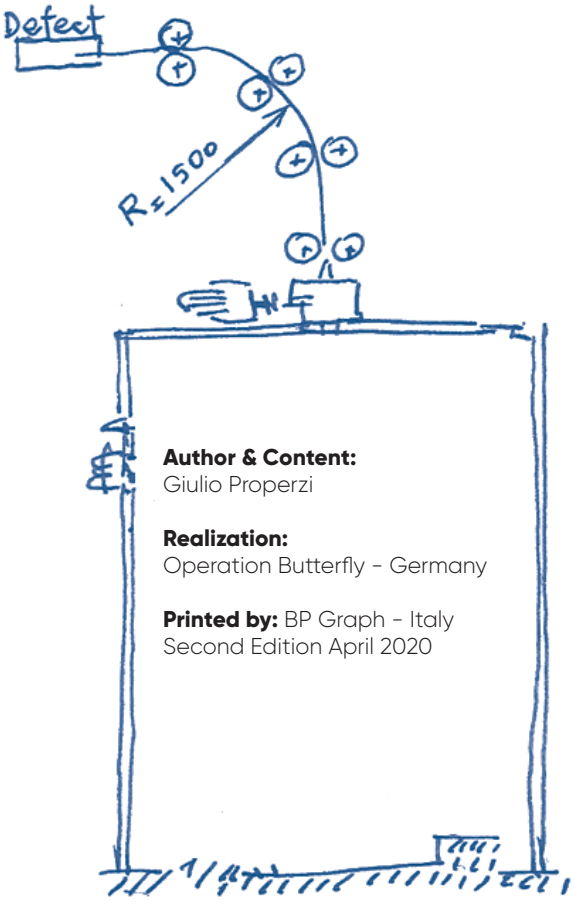
PROPERZI

ETP Rod and Copper Wires

The dancing satyr, **copper** *Statue, in Sicily, 300 B.C. ca.*



Continuus Properzi



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Realization:
Operation Butterfly - Germany

Printed by: BP Graph - Italy
Second Edition April 2020

A Company Lasting Three Generations

What makes things unique are the bonds they share, and what makes bonds unique are their quality and strength. The more continuous these bonds are, the more this strength becomes tenacity, power and finally, passion.

In my opinion, this is perfectly embodied in more than 70 years of the success and continuity enjoyed by our Italian company. Founded and based just outside Milan, the company has grown and flourished, gaining worldwide renown for its revolutionary technological processes for non-ferrous metals.

These 70+ years of birth, growth, battles, successes, technological inventions, victories, failures, new patents, sweat and so much drive make up our story; not just one of a family, but of all the people who have believed in us and played a part in this, of all those who see our business as the perfect measure of outstanding innovation, tech-nology, commitment and loyalty.

This is us: we who strive for the best technological solution to make the systems and machines we produce simpler and more user-friendly, tailoring them to meet the re-quirements of our many clients worldwide.

We who help them remotely or come to their aid on site with our technicians, taking care of their every need and request, and working to ensure that each and every project is a success.

We who want all our systems to run like clockwork.

This means we always put you, our clients, first, you who were the first to believe in our endeavour, and you who have had faith in us for more than 70 years, fully aware that our passion for our job is our constant driver for continuous growth and techno-logical innovation.

Our family and the company-bonds that I mentioned before do the rest, and I am confident that they will allow us to work in the same way, and better, for many years to come.

Continuus-Properzi... A family passion!

By Chiara Properzi

From Innovation to Innovation

Yesterday, today and tomorrow

"It's no secret that copper wire and cable makers are chasing around to come up with cost-cutting method that would give them an edge in the highly competitive fields... It's a tool that will provide a means to a manufacturer to operate in the black in a highly competitive market". It is a very banal and uninteresting incipit describing Continuous Casting of Redraw Copper!

But it changes color and significance if you know that it is from Mr. Ilario Properzi's interview with American Metal Market on May 16, 1963, just one month before the first ever continuous copper rod was produced by a brand new Properzi System in the USA. It was the beginning of a new era thanks to Ilario Properzi and his ingenuity!

Since then, dozens of prominent individuals and companies have contributed to the development and optimization of ETP copper rod production plants up to the current astonishing production rates (40 tph and more) and drawability (down to diameters of 0.10 – 0.05 mm diameters and smaller processed by high speed multiwire drawing machines!).

We are proud of our founder, the inventor of the CCR process for nonferrous rod, we added his name to Continuus, renaming the company Continuus-Properzi Co. We are equally confident of the inventiveness and strong leadership shown by Giulio Properzi, our President, and in the commitment and capabilities of the entire Continuus-Properzi team.
Step by step, our company, despite some unfair competition and baseless gossip, has developed into a true EPC supplier that has accumulated the longest worldwide experience and relevant know-how regarding complete **ETP or FRHC Lines**, from furnaces to coiler, for the copper rod and wire industry.

Our commitment is to continue and surpass the 70 plus years of success of our company based on the continuous attentiveness to our customers and to the future requirements of the global market.

Our latest innovations include the Microrolling® Mill process for self-annealed copper wire, a promising revolutionination of the drawing shop and the new Vert-Ref process to recycle Copper scrap into FRHC products.

As a true engineering company we feel confident in providing full packages from finished foundation to plant in operation.

Always looking forward and always a step ahead is our mantra as we march toward our centenary anniversary!

The Wire Association International, Inc. (WAI) honored father and son with Mordica Awards (Ilario Properzi in 1973 and Giulio Properzi 30 years later in 2003), for their contribute to the wire industry's base through research, development, innovation and other technical pursuits.

Quality First

Quality is our goal and safety is first

Continuous Casting & Rolling Copper Rod Line.

It is commonly known that the increasing and increasing quality of the rod from continuous casting & rolling Lines allows multiwire drawing down to very fine diameters of 0.10 mm – 0.05 mm at speed near 30 meters per second. But what is possible is not automatically reached!

Under such operating conditions, it is not only necessary for rod producers to provide high quality wire rod but, far more importantly, the quality of the ETP rod must be easily measureable and consistently repeatable.

The efficiency of a Plant, in terms of rod quality and transformation costs, is the critical point for a rod producer in any part of the world! For new installation the following "factors of success" are mandatory:

- The first class Properzi Line from furnaces to coiler
- The applicable package of modern GMPs (Good Manufacturing Practices)
- On-site assistance, as well as support from our Technical Office, based on know-how and expertise collected over the last 50 years
- A skilled, well-trained and motivated Operational Team

To repair the obsolescence of those Systems (Plant + GMP + Team) commissioned years ago, when the rod requirements were far less severe, our Excellency Group can provide all the support necessary to attain the quality standards that are a "must" today with a reasonable and justifiable investment.

In parallel, "while posing no danger to the Owner's balance sheet", we can supply dedicated retrofit kits to update those older machines which have become obsolete. It is not the major things but the little details which make the difference; like we always say, "the devil is in the details!".

Our experts can suggest how to modernize the Line and also transfer the "Total Quality" and "Zero Defects" approach following the methods that the Automotive Industry – the most demanding industry – has identified, implement-

ed and improved upon year after year. Several courses are available in our QUALITY ROAD MAP (QRM), for example:

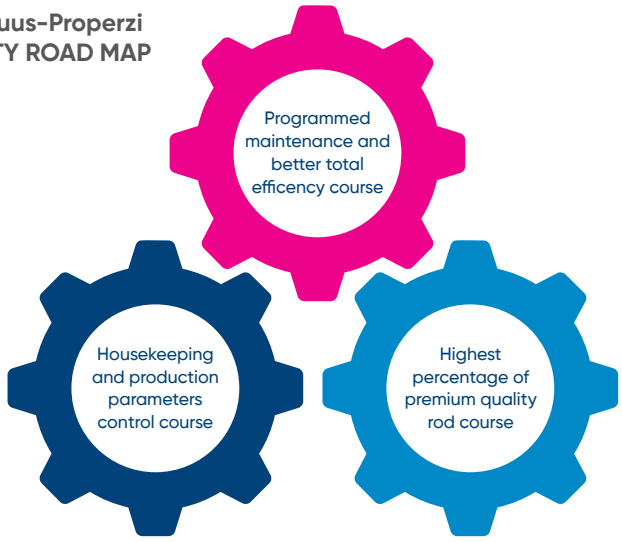
- Programmed maintenance and better total efficiency course
- Housekeeping and production parameters control course
- Highest percentage of premium quality rod course

We are making the European Norm for Safety and Total Quality Policy familiar around the world. They are known as OHSAS 18001:2007 and ISO 9001: 2008 or ISO 14001:2015, respectively.

QUALITY IS THE COMBINATION OF GOOD MACHINERY AND GOOD MANUFACTURING PRACTICES.

Just to give an example, consider the QRM that we implemented together with an important customer located in Asia:

Continuus-Properzi QUALITY ROAD MAP (QRM)



The Properzi ETP Copper Line was commissioned in 1995 - output rate was 10 tph.

QRM was implemented during 2014 and the starting conditions were:

- OEE ≤ 75%
- Average drawability ≥ 0.25 mm
- Rate of rejected rod by the drawing shop 5%

After two visits of our Experts for a total time of four weeks the conditions improved to:

- OEE ≈ 80%
- Average drawability ≥ 0.15 mm
- Rate of rejected rod by the drawing shop 1%

... and the Line continues to operate with a consistent economic return.

Properzi Technical Consultancy:

Now Continuus-Properzi is offering a special Service to all Properzi Users that is delineated in three different options:

- **Written Consultancy** - It is a fast "problem solving" approach based on information exchange via e-mail. The Customer will explain the issue to consultancy@properzi.it describing it in detail, clarifying in which specific cases it occurs and adding any meaningful pictures or additional information. Properzi will deploy its dedicated and qualified engineering/process team until problem resolution.

- **Remote Assistance Service** - It is a direct point to point connection between Properzi's control room and Customer Line PLC. To be used only when the need arises, it allows CP software and process specialists to operate on the Customer PLC in order to introduce any required adjustment/modification either to the software or to the working parameters. To enable the Remote Assistance Service a communication module (included in all PLCs recently supplied), has to be installed and connected to the Internet.

- **Technical Audit at Customer site** - This requires dispatching Properzi's specialist/s to site in order to assist the customer in resolving the most critical issues, the ones which cannot be addressed by mail and require Properzi's physical presence on the Line. The Technical Audit will be quoted on a case by case basis by our Technical Consultancy Manager.

Continuous Customer Service

The concept of responsible business

Continuous Casting Lines for the production of non-ferrous commodities are considered large scale durable equipment where the availability of efficient Aftersale Service is one of the discriminant factors for extending the technical life of the plant maintaining the maximum level of the production quality. For the last several decades, and due to the above reasons, Properzi's culture regarding Aftersale Service includes two main sectors of activities:

- The on site technical assistance
- The spare parts services

Both sectors include technicians and engineers with great experience. In particular, the Team of Technical Assistance is composed of 30 individuals including electrical/electronic engineers/experts and mechanical/process engineers. Most are young, they are all motivated and well prepared, and they must undergo strict training before deployment in the field; Continuus-Properzi requires a minimum of five years experience.

During the phases of commissioning and startup of a new plant our service spans from foundation verification through the supervision of machinery alignment on the civil works, from the training of the operators through the supervision of the no-load tests, and from the supervision of the hot metal tests through the demonstration tests of the performance parameters.

From this moment through the entire technical and/or economic life of the plant our **Aftersale Service is in close contact with the customer to provide spare parts, technical consultancy and also remote assistance.** Spare parts are the lifeblood of the plant and extending the technical life of the plant very much depends upon the availability of spare parts. Especially during the first two-three years of plant operation we try to guide the customer in scheduling/managing their spare parts inventory as a function of the expected scheduled production so as to diminish the risk of facing urgencies and/or problems.

Yes, supplying a new plant for the production of non-ferrous commodities is not only Properzi's core business but an act of total responsibility and commitment where first class equipment must be accompanied by first class Aftersale Service; in essence it is a real "marriage" with each customer which lasts for several decades!

Onsite technical assistance.

Spare parts the lifeblood of the plant!

The History of a Company

Properzi «chronological»

CHIARA PROPERZI
nowadays
MEMBER OF THE BOARD *

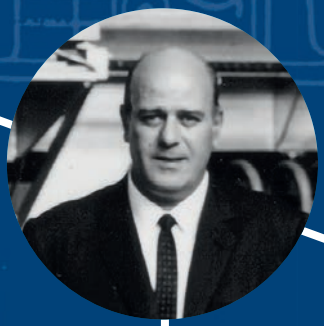
STEFANO PREVEDINI
nowadays
PROCUREMENT DIRECTOR*

MARCO MARCOLUNGO
nowadays
CHIEF ACCOUNTANT *

GIULIO PROPERZI
nowadays
PRESIDENT *

SERGIO VALENTI
CHIEF MACHINARY DESIGN
from 1975 to 2015

DENNIS K. PETERS
TECHNOLOGIST
from 1965 to 2000



UMBERTO SCOINO
TECHNICAL DIRECTOR
from 1963 to 2000

ILARIO PROPERZI
FOUNDER
from 1947 to 1976

is a History of People

Parents Tree

ALBERTO ANNONI
nowadays
ENGINEERING SUPERVISOR *

DIMITRI CORDUBLAS
nowadays
FINANCIAL DIRECTOR *

DAVIDE IOSA
nowadays
TECHNICAL DIRECTOR

CARLO NERI
TECHNOLOGIST
from 1965 to 2017

ROLF C. REUTER
COMMERCIAL DIRECTOR
from 1980 to 2002

ENRICO DONINI
SALES MANAGER
from 1953 to 1971

* BOARD OF DIRECTORS

Our Big Data Deposit

The hidden treasure of the Properzi heritage

One lay-out now storaged in a CD-ROM.

Continuus-Properzi Design.

Continuus-Properzi, founded in 1947, is celebrating the 70th anniversary in 2017. Over the years we have designed, manufactured, sold and commissioned several hundred machines and complete rolling lines. **Even for the oldest machinery, placed in operation five, six decades ago, we have kept the complete technical file for each piece of equipment. This is our way of keeping alive all the Properzi equipment that serves or has served our clients worldwide.**

This philosophy allows us to supply spare parts and/or technical consultancy even for our oldest machinery. **This was the case when the Leonardo da Vinci National Museum of Sciences and Technology, in Milan, decided to dedicate an entire hall to Ilario Properzi's invention: the Continuous Casting and Rolling system for aluminium rod.**

The very rusty and wrecked first aluminium rod line has been totally restored exactly as it was in 1949 and is now permanently exhibited as an example of Italian ingeniousness. You can count on one hand the number of casters or rolling mills commissioned during the period 1955-1965 that are still in operation today. Many lines were delivered during the decade 1965-1975 and more than 150 plants were commissioned during the past 40 years.

No one has ever counted how many designs or papers are archived in our facility and how many different mechanisms were used over the years for the creation and storage of these documents: for example big rolls of manual India ink designs scaled 1:1 for an entire rolling mill (4.5 x 1.8 meters!!) or microfiche or tapes or CD-ROMs as well as the latest systems and devices from Silicon Valley. A real mess... **but nothing has ever been lost and these items serve as our memory disk for assisting hundreds of clients with all details relative to their specific equipment.**

To complete our archives, all commercial papers of successful or, unfortunately, unsuccessful interaction with Customers or potential Customers are tidily deposited, like measurements in a tailor's shop, so that we too can tailor our services to Customers' specific needs.

We are ready any time!

Complete Plants for ETP Copper Rod

YESTERDAY

The history of Properzi and copper began sometime during the 1950s when Mr. Ilario Properzi started experimenting with the application of the continuous casting and direct rolling technology, already successful for aluminium rod, for the production of copper rod.
The new system was certainly able to replace the current state-of-the-art based on the hot rolling of wirebars through the so-called Belgian Looping Mills; it was indeed a new technology.

The Continuous Casting and Direct Rolling process solved the problems caused by the old technology such as:

- Very consistent CapEx
- Labor intensive and dangeous
- Tough and dangerous working conditions
- Weight of coils did not exceed 150 kg
- Low inconsistent quality

We want only recall that the first two plants were sold by Ilario Properzi, one to an American company and one to a Russian company, during the very early 1960s thus opening the route to the modern era for the production of copper rod.

TODAY AND TOMORROW

These days almost 60% of the copper produced worldwide is in the shape of copper rod to serve the cable industry while the balance goes into ingots, billets and slabs.

The demand for Electrolytic Tough Pitch (ETP) copper rod is growing at a rate of 3.5-4.0% y-o-y and we can also say that the quality requirements for copper rod are becoming more and more severe year after year.

Anticipating such market needs, Continuus-Properzi designs, manufactures and services the most advanced plants, from furnaces to coiler and packaging for the production of ETP copper rod.

Continuus Properzi 25 tph Copper Rod Plant.

FROM SHAFT FURNACE TO COILER WITH COMPLETE KNOW-HOW AND ENGINEERING

While Continuus-Properzi is constantly improving equipment and machinery, our Excellency Team looks after the best and most complete training program for the operators so as to reach the lowest possible Operational Expenditure (OpEx), the best Overall Equipment Efficiency (OEE) and the widest repeatability of the rod quality.

The table below shows the size of the standard plants available in Properzi's production program, however different plant sizes are always available upon request. Joining our family provides many benefits and we would like to list the most important ones:

- Specialized engineering for lay-outs, foundation drawings, etc., and for tailoring special technical solutions, if requested
- Tailor made machinery designed for life
- Lowest OpEx
- Highest OEE
- First class components (hydraulic, pneumatic, electrics, etc.) and user-friendly control system
- High rod quality and repeatability of the quality
- Flexible machinery
- Unparalleled technical assistance for training, commissioning and start-up and many other advantagesthat you will experience upon joining our large family of Properzi CCR users

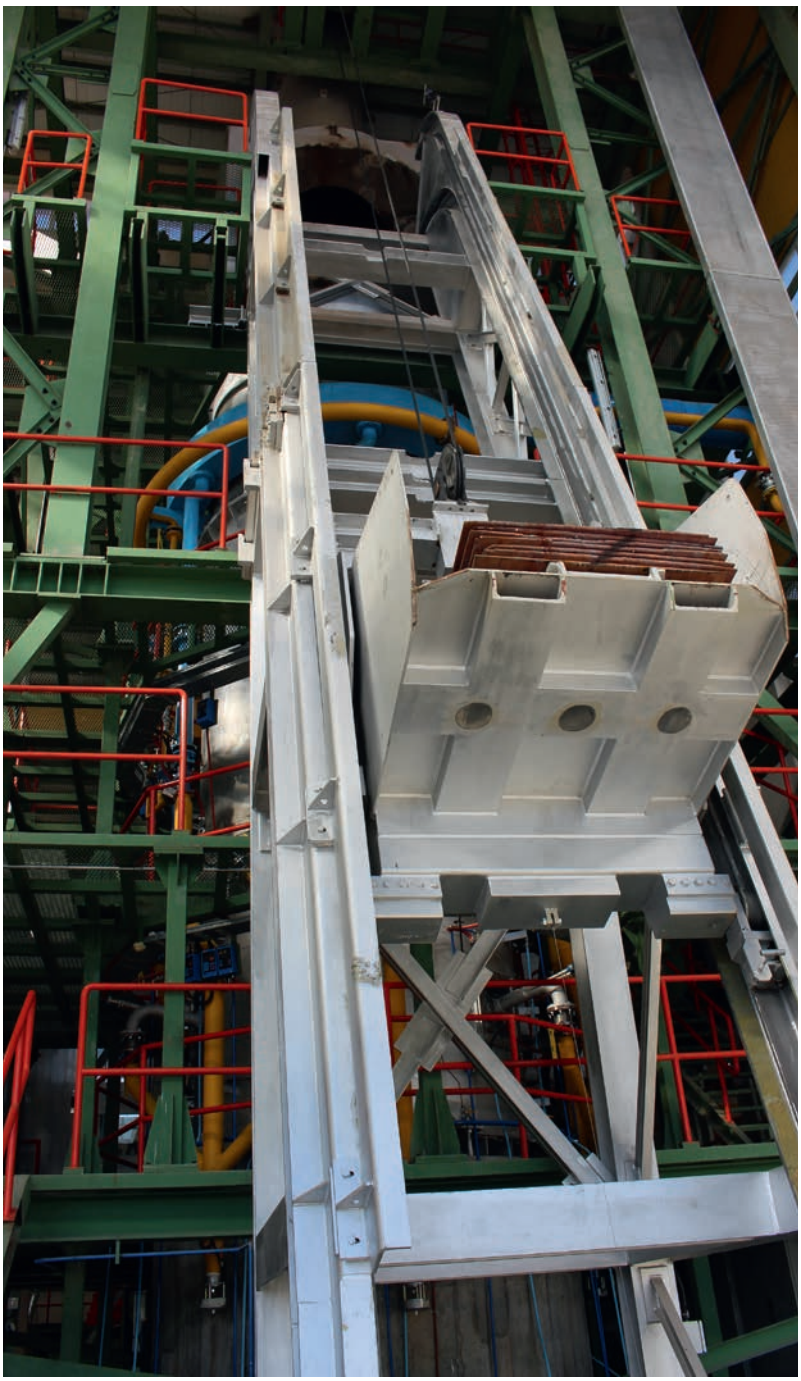
Properzi is available to supply such plants on an Engineering, Procurement and Construction (EPC) basis so that the Buyer is only minimally involved with the installation of the plant.

Output rate	tph	Expected Range 240-300 dpy
Small	6.0	30,000 - 35,000
	7.5	36,500 - 42,000
	10.0	48,000 - 58,000
Medium	12.5	61,000 - 72,000
	16.5	80,000 - 95,000
	20.0	98,000 - 115,000
Large	25.0	125,000 - 140,000
	32.0	160,000 - 180,000
	38.0	185,000 - 220,000

... it is our philosophy leaving space for future upgrade...

A large family from 6 tph up to 38 tph

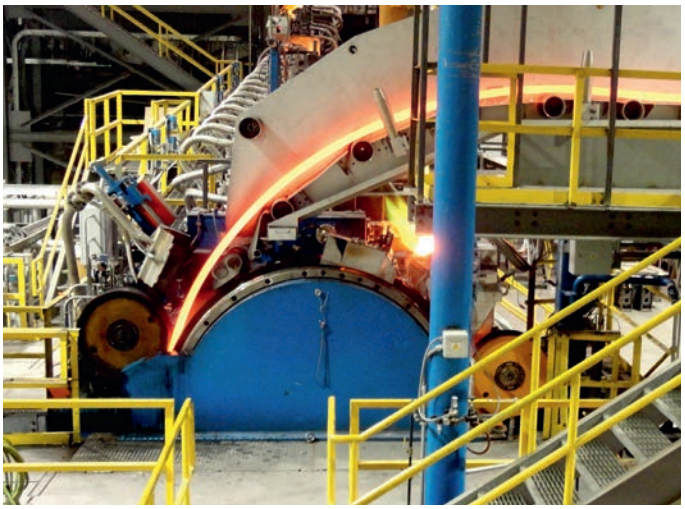
ETP Copper Rod Plants



Cathodes during charging phase.

Properzi has worked very hard during the last 50 plus years to be able to supply ETP copper rod plants that match the best combination of OEE, CapEx and OpEx. In fact, whatever the size of the plant, from medium to extra-large, the Properzi Engineering Team has dedicated extraordinary attention to the major details listed below:

- The cathodes charging machine is designed to facilitate uniform scattering of cathodes so as to enhance the thermal efficiency of the vertical melting furnace.
- The use of big-block refractories in the melting furnace reduces the refractory installation time and increases the thermal efficiency of the vertical melting furnace; the lower the gas consumption, the better the OpEx.
- The burners of the vertical melting furnace use nozzle mix burners thus enhancing both thermal efficiency and safety of the furnace; in large and extra-large plants the third row of burners are tangential burners.
- Each burner in the vertical melting furnace is controlled by a CO analyzer; additional CO analyzers control the burners of the holding furnace and launders. This allows rapid analysis and prompt feedback.
- Continuous detection of the temperature of copper mould, steel belt and cast bar through dedicated pyrometers allows immediate indication of their correct working conditions.
- The OXI-acetylene Sooting System provides precise and repeatable soot application.
- Properzi's unique combination of a roughing mill with 2-roll rolling stands that provide the necessary high reduction rate and a finishing monobloc mill with the legendary 3-roll rolling stands, driven by only one motor, ensures rod diameter tolerance which surpasses the ASTM B49 specs.



A Properzi Casting Machine.

View of a typical Properzi Roughing and Finishing Mill in operation.

All the ingredients listed on page 13, combined with Properzi's know-how accumulated since we pioneered this process, allows our Users to maximize rod quality in order to reach and surpass magnet wire specifications and drawability below 0.10 mm when requested.

Needless to say, Properzi also offers an automatic packaging system for rod coils including pallets feeding, coil compacting, strapping, wrapping, etc. Rod can be collected in rosette type or concentric coils... and the journey continues!!!

Automatic Packaging Line of a 25 tph Properzi Rod Plant.

Copper coils storaged from one 12 tph Properzi Line.

The Astonishing in Line Self-Annealing Method of ETP-FRHC Copper Wire

An energy saving policy is a must for every industry because of two reasons: energy is expensive and potentially harmful to the environment. A new method that saves about half of the energy previously required is the latest idea of Giulio Properzi and his engineering team.

This method has been named Self-Annealing Microrolling® (SAM) and replaces the conventional break down drawing machines with in line annealers.

The Microrolling® Mill, a machine that is in operation at dozens of different users worldwide for ferrous and non-ferrous wires, has been slightly modified to achieve, in the end, wire at a tem-perature high enough to obtain good annealed characteristics after quenching.

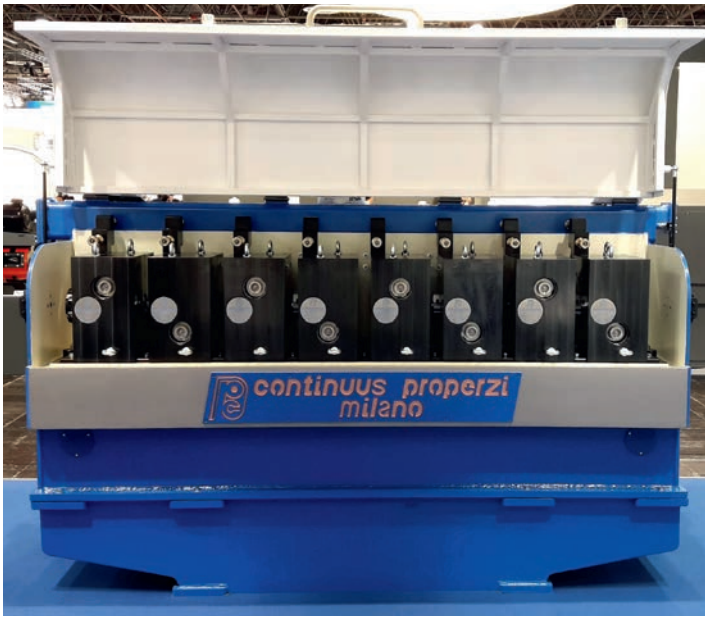
For this special application it is a Monobloc with 8 rolling stands, each one having the typical Properzi 3 rolls configuration, and one only motor. The machine is completed by an emulsion mister, an ext chamber with controlled atmosphere and a super compact quenching pipe.

It is a sophisticated machine consuming 80-90 kWh/t per ton only getting the desired elongation of the wire – usually around 30% - for the subsequent drawing process in Multi-wire Machines. While in a Drawing Machine the wire must remain at low temperature, a rolling mill can work at high temperature.

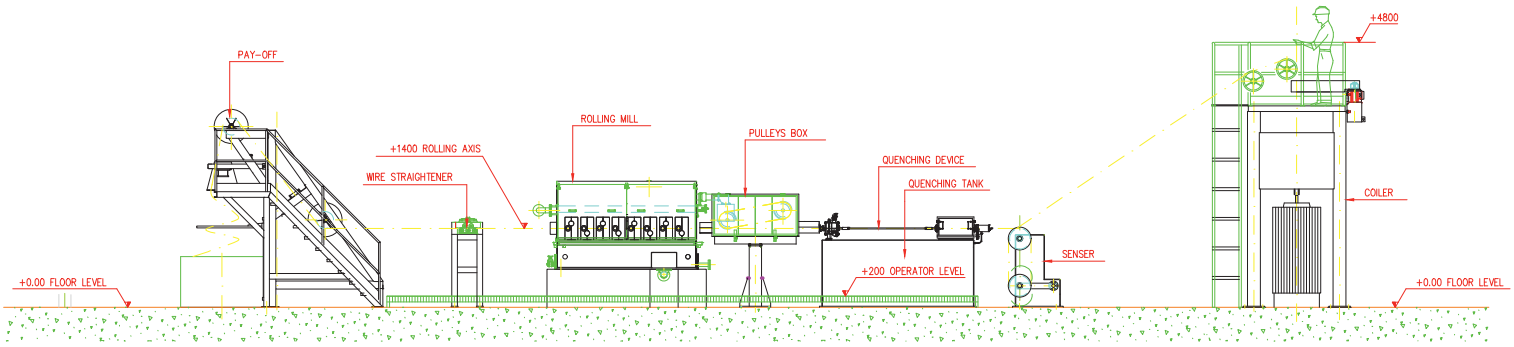
The rolling power – as theory teaches – is totally transformed in heating energy and a part of it can increase the temperature of the wire during the rolling process to levels above the annealing temperature.
This is the brilliant reasoning behind our patented idea that will probably change every drawing shop.

Here are the achieved advantages:

- **No annealer required, no maintenance**
- **Zero energy for annealing**
- **Compact lay-out**
- **Up to 100 kWh/t saved (not only in the annealing energy saved but also the deformation power required is less because the copper is rolled at an elevated temperature)**
- **Less than € 100.000 per year in energy cost**



Properzi Microrolling® Mill exhibited during Wire Düsseldorf 2018.



A Properzi complete SAM Line.

Copper Rod ø 8 mm

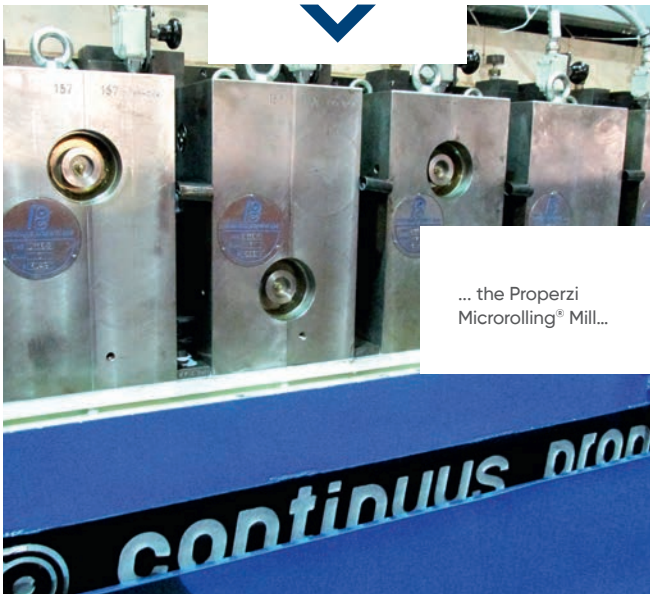
OUR PRICE FOR A COMPLETE SAM LINE IS COMPARABLE TO THAT OF THE PRIOR-ART.

Roundness of the 2 mm (1.8 mm) wire fully matches the requirements of the subsequent multiwire drawing operation.

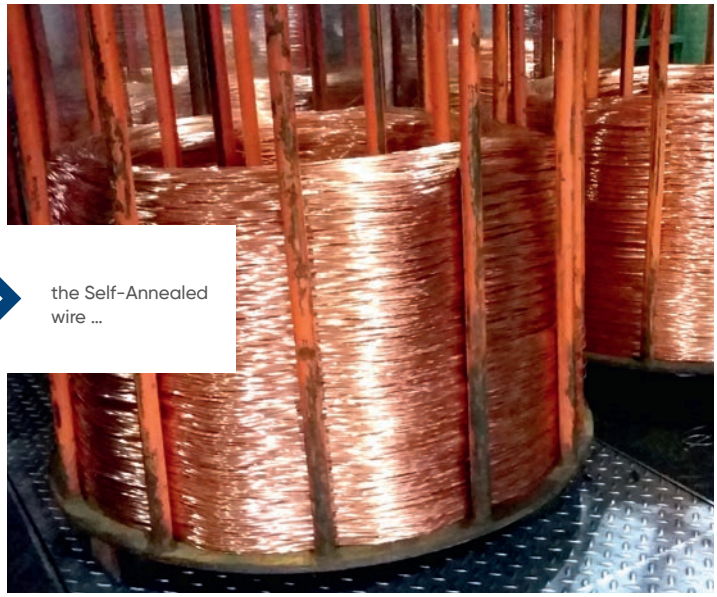
One SAM line is currently in operation at Anglia Metal in the U.K. It is very compact and operates at a 27 m/sec production rate producing 2 mm wire and will produce 1.8 mm wire in the near future.

Further more:

- **No threading – No injuries**
- **No time lost**
- **No annealer cabling**
- **Easier erection**
- **No dedicated transformer**



... the Properzi Microrolling® Mill...



the Self-Annealed wire ...

Pro-Form a Rotary Extrusion by Properzi:

Complete plant for copper shapes

Amongst the various applications of copper rod a remarkable example is the production of bus bars and other profiles through the continuous rotary extrusion process; Properzi has not lost the opportunity to enter this interesting market naturally linked to rod applications. During the past 20 years Continuus-Properzi has enlarged their range of products with an intensive know-how acquisition policy of highly reputed companies in the market and then updating and modernizing this acquired know-how and machinery.

The new rotary extrusion machinery has been branded under the name Pro-Form, which stands for Properzi Forming.

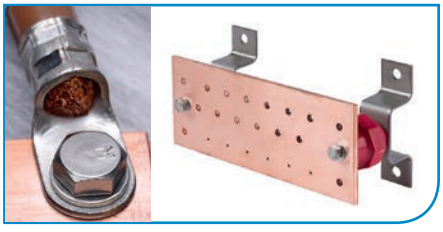
An acquisition of this type was completed during 2015. In a short time the detailed design was updated and the first Pro-Form machine is currently set up to operate with short production runs of special profiles and semi-industrial runs with different solidal conductors.

This new Pro-Form is equipped with a 300 mm wheel and motorized for producing a wide range of products and conducting tests on specialty profiles starting from Cu rod and/or Al rod if so desired.

The Pro-Form range of machinery will soon include a 500 mm wheel diameter machine. Continuus-Properzi has more then 70 year experience in the engineering, design and manufacture of for the non-ferrous industry. There are very few suppliers like Continuus-Properzi that are fully integrated with a highly reputed Technical Office, a modern machine shop and unique After Sales service. Properzi is the most qualified and reliable partner for those customers seeking a Rotary Extrusion System and the related services.

View of a typical bus bar.

A complete plant for producing special profiles



30 plus years in Fire Refined Copper:

FRHC copper rod, ingot, billet and other products

What we are talking about encompasses all types of scrap from bright copper from the drawing shop (near to cathode purity) to old scrap, with a minimum copper content around 93%. Naturally it is possible to mix many kinds of copper scrap saving hundreds of dollars per ton the raw material and this is a promising start towards satisfactory profit on your produced semis.

There are three types of Continuus-Properzi pro-cess for the production of FRHC copper:

No. 1 Process is based on one reverberatory furnace usually feeding a rod line or in ingot caster during approximately one shift per day.

No. 2 Process is based on a vertical (shaft) furnace with two refining furnaces and one holding furnace feeding a continuous or batch casting day.

No. 3 Process is based on a reverberatory furnace for ingot casting during one shift. Ingots are then diluted with cathodes in a shaft furnace for ETP rod production.

For more than 30 years Continuus-Properzi has delivered and put into operation several dozen refining furnaces for the No 1 Process mainly copper rod lines around the world in-cluding Italy, USA, Korea, Iran, Mexico, Brazil, China, India, Ukraine, Russia, Cuba and others.

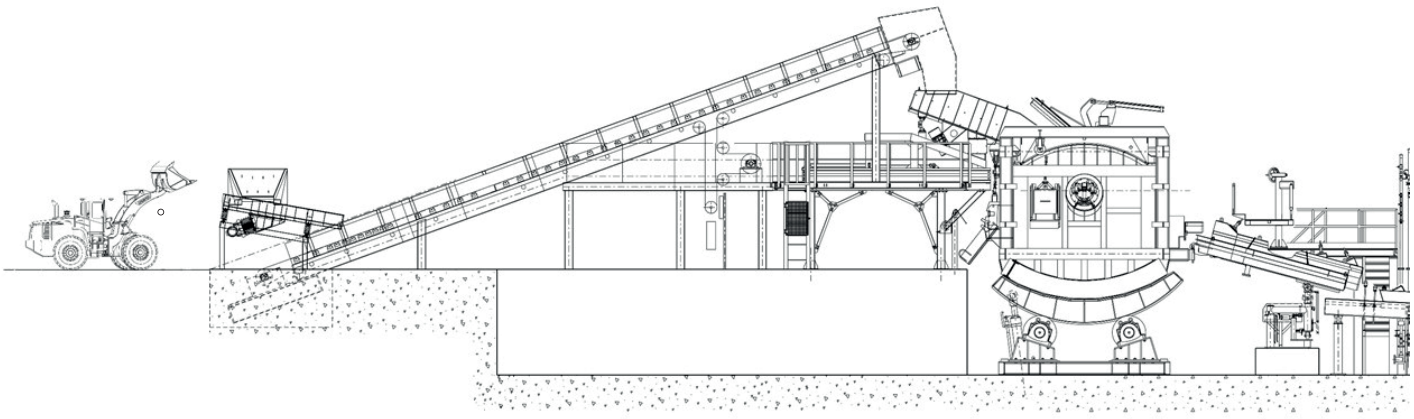
Lately Giulio Properzi patented a new design where the reverberatory furnace is loaded from the top; the first one, a capacity of 250 tpd has been in production since year feeding one 30 tph rod lines.

The latest furnaces of this kind have been recently installed in Russia and Iran with a capacity of 100 tpd followed by 12.5 tph rod lines.
When charging door is on the top of the furnace body the scrap can be conveyed by a belt through a small door minimizing heat and pollutant fumes escape. The belt conveyor can bring in one minute only about double tonnage of scrap than prior charging systems into the furnace allowing a much shorter cycle, less shock to refractories and less pollutant fumes.

No. 1	No. 2	No. 3
Copper scrap mix ≥93% 40-250 tons per day	Copper scrap ≥97% 10,000-100,000 tons per year	Copper scrap mix ≥96% 40-80 tons per day

Copper scrap before loading with the old system.

100 TONS REFINING FURNACE



In several cases the Refining Furnace is completed with a Shaft Furnace for cathodes in a way that the rod line can work almost 24 hours a day, producing about 60% ETP premium rod and 40% FRHC rod.

Over the years great work has been done by Properzi and by the Users of such technology so that the FRHC rod of today is an economic commodity which can comply with ASTM-B49-15a standards. It can be processed in high-speed multiwire drawing machines down to 0.3 mm (0.25 mm and smaller for experienced producers) and used in many engineering applications other than fine wire, as has been stated in several papers given on this subject.

The number of wire breaks per ton, until reaching this diameter, will be comparable in all respects to the best copper rod available on the market by making minor adjustments during the annealing process.

Table A: Combined lines for ETP and FRCH rod

Refining Furnace Capacity [t]	Cathodes Furnace and CCR Capacity [tph]	Expected FRHC rod output [tpy]	Expected ETP rod output [tpy]
40	6	12,000	21,000
60	8	18,000	31,000
80	12	24,000	42,000
100	15	30,000	52,000
150	20	45,000	78,000
200	30	60,000	100,000
250	35	75,000	130,000

Note: The above yearly output is based on 300 dpy. It is also possible to install a couple of Refining Furnaces doubling the output of the third column.

The level and the kind of impurities in the scrap make the big difference. When it is possible to buy second quality copper scrap with copper content ≥ 97%, such scrap can be processed by using the new Vert-Ref, a continuous system of furnaces.

The loose or baled scrap is charged at the top of the shaft furnace by a front loader using a dedicated ramp. At the bottom of the shaft furnace the melted copper is collected in a basin where it is treated and slagged.

Two launders bring the melt to a couple of holding/refining furnaces which alternate with one another. Refining is made with special additives.

This furnace set called Vert-Ref, corresponding to our No. 2 Process, can feed Properzi rod lines ranging in size from 6 up to 20 tph.

There are cases where the CCR rod line has a combination of furnaces: one Vert-Ref furnace set working about 16 hours per day and one reverberatory refining furnace for very low grade scrap (≥ 93%) feeding the caster for the rest of the day.

One more system to recycle scrap is available and in use. This is the No. 3 Process commonly known as "off line" process and is intended to produce ETP rod in a second step.

In the larger rod systems using consistent amounts of cathodes it is possible to mix a small percentage of FRHC ingots with cathodes and get ETP quality.
Usually the "off line" system recycles internal good purity scrap with some scrap from the market so the required refining is much less intensive than in the No. 1 Process; therefore the tilting furnace is simpler and the caster is a standard open top mould chain.

In summary, regarding the reclamation of copper scrap, Properzi is willing and able to offer and support the following:

250 ton Refining Furnace with Patented Loading System from the Top in Operation.

- Complete plants for producing FRHC rod equipped with one or two reverberatory furnaces with daily output ranging from 40 to 250 tons.
- Continuous Scrap Melting and Refining System for cleaner scrap with output of FRHC rod ranging from 6 to 20 tph.
- Combined plants for the production of ETP and FRHC where the CCR line is fed for approximately 14-15 hours with liquid metal coming from a vertical furnace using ETP cathodes and for the remaining time up to 24 hours the CCR line is fed with FRHC metal. This system gives the maximum flexibility of using both raw materials (cathodes and scrap) either on a daily basis or on a campaign basis according to the availability of scrap and cathodes.
- Last but not least, the "off-line" system for the production of ingots or plates to be blended in with the cathodes charge of existing ETP rod facilities.

Properzi is also available to supply such plants on an Engineering, Procurement and Construction (EPC) basis so that the buyer is only minimally involved with the installation of the plant.

Table B typical chemical composition and characteristics of FRHC rod

Parameter	Reference	Value
Chemical composition	Cu+Ag %	>>99.90 ÷ 99.92
Oxygen	ppm	150 ÷ 250
Elongation	A_{100}%	45 ÷ 51
	A_{200}%	38 ÷ 43
Tensile strength	Kg/mm²	22.8 ÷ 23.5
Conductivity	IACS %	100.5 ÷ 101.3
Twist test to failure	Number	43 ÷ 50
Best drawability	mm	0.25
POPS test – surface oxides	Ångstrom	100 – 200
Re-crystallization temperature	°C	250 ÷ 280

A view of a Properzi Copper Line for ETP and FRHC Rod, 12.5 tph

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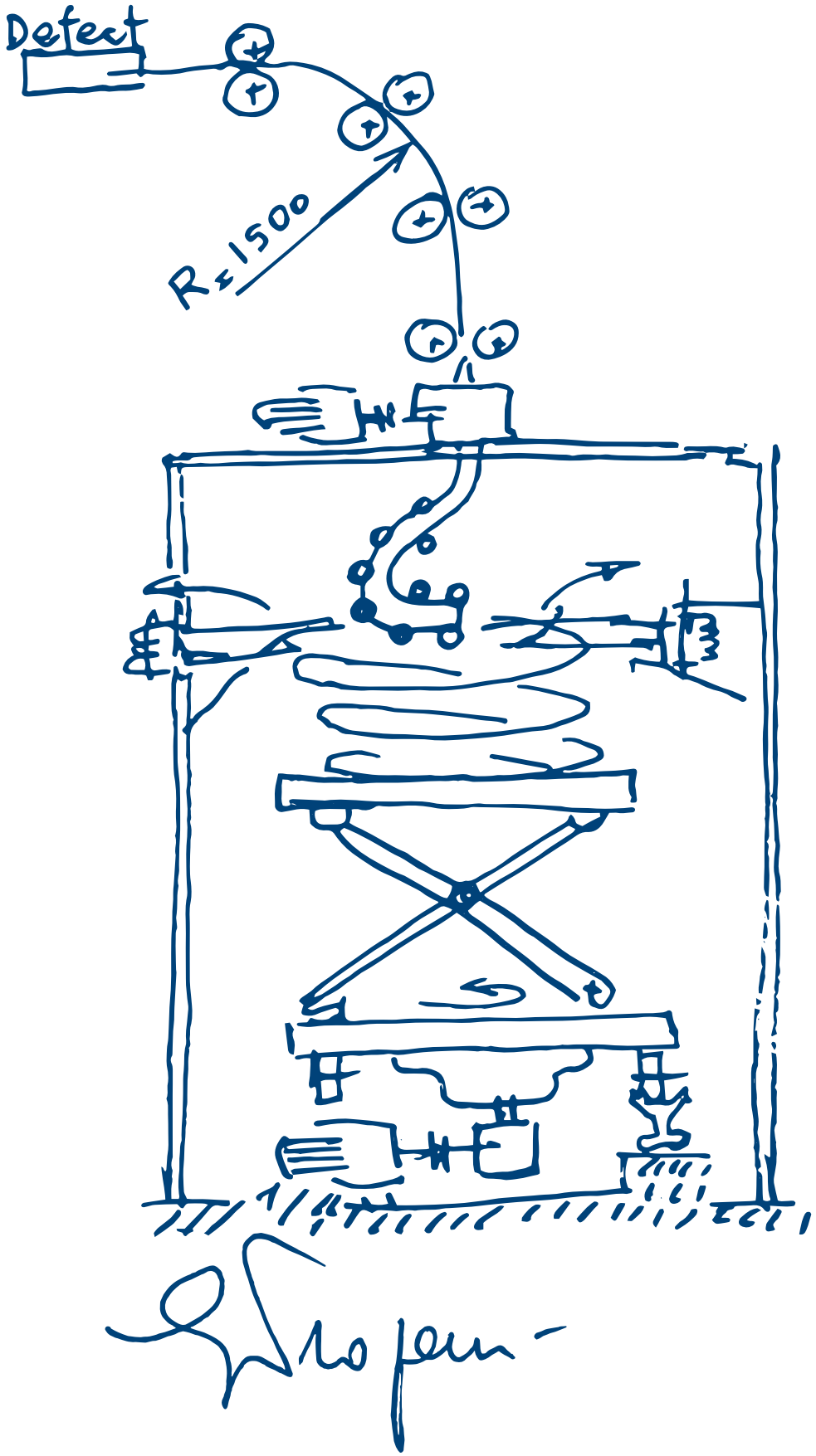
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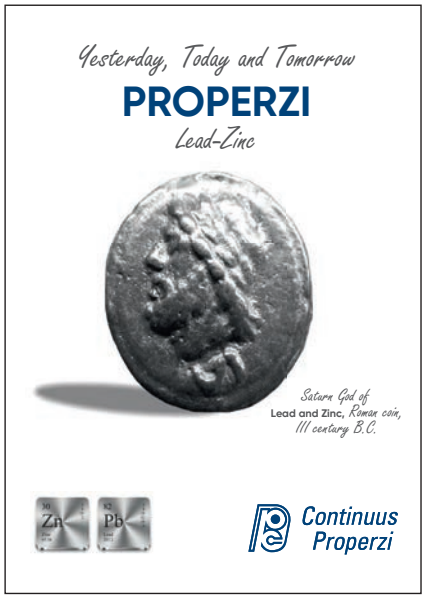

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