NEW SOLUTIONS FOR THE NEW NORMAL: ENHANCING COMPETITIVENESS OF DISCONTINUOUS COLD MILLS AND STRIP PROCESSING LINES*

Ruediger Holz[1]
Mauro Olivotto[2]

Abstract
Design, build and start-up innovative, state-of-the-art, CAPEX and OPEX optimized Cold processing lines to produce high quality steel, in close partnership with our customers worldwide.
Core technologies used for these innovative plant concepts are Danieli's new developed, high efficient laser welding technology, the newly developed Yield Boost Technology to significantly reduce yield losses at the strip ends as well as the OSRT technology for best strip flatness results.
In galvanizing lines, the zinc pot is the most effective area to reduce costs in operation and consumables and at the same time increase the product quality.
Keywords: Yield Boost, Laser welder, X-Jet Air knife, Q-Robot-Zinc.

[1] *Executive Vice President Danieli Wean United – Flat Product Rolling Mills and Strip Processing Lines, Danieli &C.OfficineMeccanicheSpA, Buttrio, Italy.*
[2] *Deputy Director – Cold Flat Products, Danieli Automation S.P.A., Buttrio, Italy.*

** Technical contribution to the55º Seminário de Laminação e Conformação de Metais,part of the ABM Week, October 2nd-4th, 2018, São Paulo, SP, Brazil.*

1 INTRODUCTION

1.1 Danieli's primary mission

A significant amount of cold rolled sheet is produced worldwide on discontinuous operating rolling mills. In a highly competitive environment, the reduction in operating costs and increases in production yield and product quality are permanent requirements for our customers.
For this reason, Danieli supports by offering innovative, CapEx- and OpEx-optimized process equipment.
The CRM PLUS, featuring a new laser welder technology, and the "Yield Boost" technology are two examples of innovative mill concepts that can guarantee annual savings of up to millions of USD.
For the galvanizing lines, the significant efforts spent in developing a fully integrated system to perform a wiping process with high quality, economy, accuracy, and productivity have succeeded.
The X-Jet air knife, the electromagnetic strip stabilizer, and the Q-ROBOT Zinc are examples of main innovations achieved.

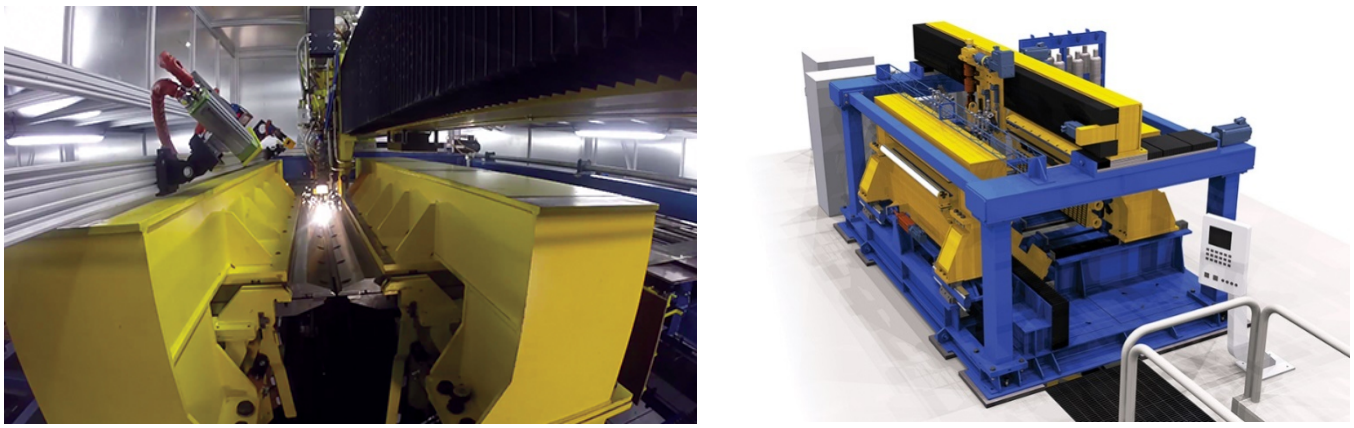

Figure 1. The new Danieli Laser welder features high energy-efficient fiber laser technology. All head and tail-end cutting, notching, and hole punching is performed by the laser welder.

2DISCUSSION

2.1 Increase material yield of discontinuous cold mills

Danieli Yield Boost technology is the right answer to significantly increase material yield with limited CapEx.
The usual way to operate a cold reversing mill for strip threading and tail-out is to open the roll gap. Danieli developed a reliable method for already partial strip thickness reduction during threading in and tail out phases.
Operating results at a two-stand reversing mill show an impressive increase in material yield of up to 1.6%. Depending on specific conditions, this technology creates annual savings in six- or even seven-digit USD figures. From studies conducted for a two-stand cold mill at a SEA location, dedicated to full-hard cold-rolled sheet production, the results showed annual savings of approx. 1 million USD.

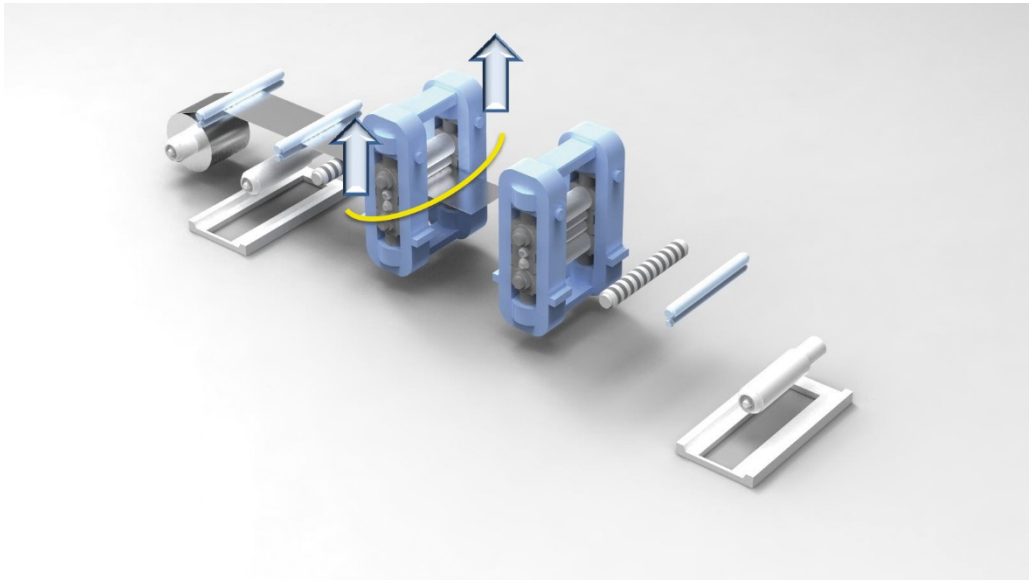

Figure 2. The CRM PLUS and the “Yield Boost” technology are two examples of innovative mill concepts that can guarantee annual savings in six- or even seven digit USD figures.

With a return of investment below 12 months, an increase in production of approximately 14% and a product yield of 99.4% (close to that of a continuous operated rolling mills), Danieli’s CRM PLUS technology is a very interesting opportunity for customers intending to increase their production in phases, as well as for operators producing high-value steel grades on discontinuous lines. Furthermore, this innovative mill concept allows the processing of coils up to 60 tons in weight, thanks to a laser welder on the reversing-mill entry side.
An example for installing a final capacity of approx. 860,000 tpy in phases, to follow the market requirements, shows the superiority of the Danieli CRM PLUS technology. Result: Only two rolling facilities are required instead of three, at lower overall investment and operating costs, and at the same time with increased product yield by impressive 1.6%.
Because the standard for competitiveness also concerns finished-product quality, as well as the market trend towards increased material strength and thin gauge rolling, Danieli technology also features optimized roll diameters, increased roll grinding ranges, and the OSRT roll shifting technology, leading to increased roll service life, further improved strip flatness, and reduced strip edge drop.
Semi-continuous rolling processes, like the CRM PLUS technology, ensures reliable, compact, low-maintenance, and fast strip-joining equipment.

The newly developed Danieli Laser welder features many innovations, e.g. high energy-efficient fiber laser technology. All head and tail-end cutting, notching, and hole punching is performed by the laser itself. No mechanical shears are necessary which supports compact dimensioning and reduced maintenance costs.
Fast and easy installation in existing lines is also possible.

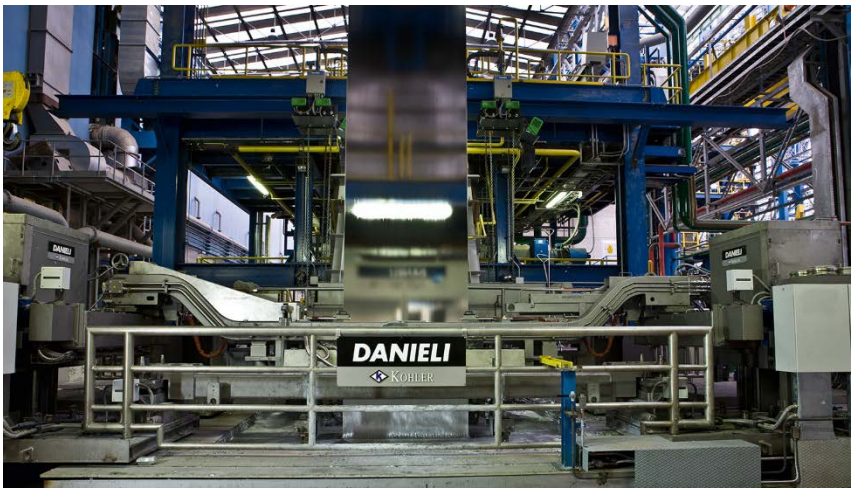

Figure 3.X-JET air knife perform excellently both in terms of minimum coatings versus line speeds, and thus productivity, and of coating uniformity.

2.2Reduce OpEx and increase product quality of galvanizing process

In galvanizing lines, the zinc pot is the most effective area to reduce costs in operation and consumables, and at the same time to increase product quality.
Insufficient wiping capacity often results in a bottleneck for the line productivity and coating uniformity of the final products.
This is why Danieli concentrated its efforts in continuously innovating the wiping process.
The technological package so developed is ideal also for upgrading existing lines.
The core is the X-Jet air knife. Its innovative design creates highly stable static pressure with direct impact on the shear effect, and extremely accurate pressure along the strip width.

Figure 4. Installations of Q-Robot Zinc have proven significant zinc savings, which is due to the optimized and repetitive zinc dross skimming operation, leading to return of investments typically less than one year.

These features ensure higher wiping capacity, better coating uniformity across the strip width, minimized and more uniform coating weight, and increased process speed, leading to higher productivity. The further on developed Compact X-Jet air

knife is designed to be even more easily integrated in already operating galvanizing lines.
Using the new Danieli Electromagnetic Strip Stabilizer, strip vibrations are cut down, strip is better flattened, keeping a constant strip pass line by means of contactless electromagnetic forces.
With this system, the air-knife-to-strip operational distance can be reduced, leading to further increase in wiping performance, both in terms of minimum coatings versus line speeds, and thus productivity, and even better coating uniformity can be achieved.
A closed-loop control for coating weight, including a sophisticated coating model, long-term adaptation functions, as well as precise controllers for air knives distance and pressure, supports a tight coating weight accuracy and fast adjustment in case of flying product changes.
In a galvanizing line, human operation is most challenging in the zinc pot area. To reduce human intervention and health risks, Danieli developed a robotic system designed to skim the surface of the zinc bath, remove dross and place it in a dross container.
The Q-Robot Zinc can be fully integrated to the Level 1 automation system and automatically follows the bath level, optimizing the skimming action.

Figure 5. Galvanized coils yard

3 CONCLUSIONS

The market for cold rolled and galvanized strip has become highly competitive, forcing producers to establish continuous efforts to reduce costs and improve product quality and productivity.
With the latest rolling mill concepts and technologies, as well as integrated technological packages for wiping process in galvanizing lines, Danieli is providing answers to these ambitious targets.
Installations in both greenfield plants and -as upgrade packages- in existing lines already have proven the superiority of these new technologies.

REFERENCES

1 John D. Anderson Jr., Introduction to Flight, McGraw-Hill, Columbus, OH, 1978, pp 357.
2 Ed. – J.J. Moore, Chemical Metallurgy, Butterworth-Heineman Ltd., Oxford, United Kingdom, 1981, pp 188.