

# EVOLUTION IN METAL CUTTING FOR ROLLING AND FORGING PLANTS \*

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## Abstract

### Evolution in Metal Cutting, applying a new cutting technology

The evolution in Metal Cutting: Inventors around the world have been successfully developing innovations for decades, but only some of these developments have had „GAME CHANGING“ potential. One of these innovations is the new developed saw blade LINCUT®, a patented changing system that paves the way for a fundamental reorientation of the entire saw blade industry worldwide through a simple and economical concept for rolling mills or heavy forging lines. Cost efficiency starts with the raw material: Circular saws equipped with a standard saw blade are expected to have a necessary 2 percent standstill per year due to required tool changing. The applied technology reduces this unnecessary loss of production by more than 50%. The ROI can therefore be reached faster which immediately lowers your production costs. No matter what material, conventional carbon steel or highly alloyed stainless steel, the coating and shape of carbide plates is perfected for extended tool life up to 25% with increased performance. Due to LINSINGERs own tool-technology-centre in Austria specialized in research and development of tools, constantly expanding R&D activities, best results are achieved in quality and cost efficiency: a (r)evolution in metal cutting.

**Keywords:** long products, sawing evolution, carbide plates.

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## 1 INTRODUCTION

The conventional saw blades are about to disappear in future, as this new Sawing Technology with replaceable carbide tips excels even under the toughest conditions at site. Linsinger has developed a technology already proven on an industrial scale, and performed more than 100.000 cuts on different materials, blooms, billets, tubes and pipes.

With the new Disc Miller (LINCUT®), this technology has scored another technical break-through: Screw-on cutting tips made of coated carbide metal, which are very easily to change, and revolutionize the cutting of steel billets – clearly a much more economic solution than the conventional brazed saw blades.

It is now possible for the operator to quickly and cheaply replace worn and broken saw teeth directly on or at the sawing machine. The old cumbersome method of dismantling the conventional billet saw blade, transporting it to the resharpener shop for repair and resharpener is now obsolete. This means less machine idle time and higher availability. The more stable Disc Miller allows the cutting capacity to be increased by 25% and reduces simultaneously resharpener, transportation, storage and operating costs.

## 2 APPLIED TECHNOLOGY

The coating of the cutting tips is designed for optimum life time and the base body is especially robust. One base body can be used up to 60 times before it needs to be replaced. This means a considerably lower stock of sawing blades being required, thus reducing the procurement, storage and operating costs enormously.

All in all, the life time of the tools is up to three times higher than the standard sawing blades, depending on the processed material. The harder the

separating steel, the greater the service life advantage is.

### 2.1 Removable tips

Higher cutting capacity results in higher performance and lower costs per cut. The tool-life is increased up to four times compared to conventional technology. In figure 1 a typical shear blade is shown demonstrating the blade with removable tips.



Figure 1. Shear blade with removable tips

The essential hallmark of the LINCUT® Disc Miller System: The carbide inserts are not brazed but screwed onto the body of the saw blade. So if required, the inserts can be easily changed by the sawing machine operator himself. Further, a complete tool changing system has even developed, from the screwdriver up to the transport carriage to keep the changeover work quick and simple. The special screws, which fix the inserts on the base body, have also been purpose engineered by to optimize the tool change procedure.

### 2.2 Reliable applications in all kind of cutting technologies

“This innovation is already state-of-the-art and many times tried-and-tested. Globally leading seamless tube mills all over the world have already switched to it effectively.”[1] With more than 100

LINSINGER carbide circular sawing machines, this proven technology system is already wide spread in the industry.

Thanks to the numerous advantages of the disc miller, there are calculations that prove beyond any doubt that a seamless tube mill makes profits worth several millions of Euros per year, thanks to the additional manufacturing time, the saving of tools costs and personnel as well as the increase in the cutting performance.

Disc Millers are available with diameters from 660 up to 2500 mm exclusively for LINSINGER sawing machines. The combination of machines and tooling from a single, reliable source is the competitive trump card exclusively available to all customers, who benefit from LINSINGER's sawing technology founded on the world's largest sawing machine manufacturer Wagner Germany. LINSINGER now extends this role as the number one global player in the field.

### 2.3 Increased demand for "The Right Inclination"

The inclined bed circular sawing machines type KSS, available exclusively from LINSINGER, have already been mentioned in connection with LINCUT. The new generation of KSS Inclined Bed Sawing Machines combines all the benefits of vertical and horizontal sawing: The KSS 3-point clamping system ensures more secure clamping while allowing for greater material deviations. Cutting forces are directed into the foundations, the sawing machine is more rigid and the chips flow straight down to the conveyor. The 45° inclined bed circular sawing machine is especially suitable for large billet diameters of up to 780 mm, and allows blade costs to fall below 2 Euro per cut.



Figure 2. Cutting equipment showing the optimum cutting geometry (applied angle) at KSS 02

The inclined bed circular sawing machines are the ideal solution for a wide range of applications, including steel & tube mills, forging plants, rail-wheel manufacturers and automobile suppliers. All the leading names can be found on LINSINGER's customer reference list. For example, one leading automobile supplier is now benefitting from over 20 inclined bed circular sawing machines from LINSINGER.

A leading customer originating from India has ordered 8 LINSINGER sawing machines for one of the largest tube mills in the Gulf. A further 13 large carbide tip circular sawing machines are now being installed in a Brazilian tube mill in Minas Gerais area. Almost 60 machines are now

operating in Russia, where LINSINGER has proven its technical performance as the clear favorite.

## 2.4 No need of sawblade re-sharpening centres for seamless tube mills anymore

Manufacturing of seamless tubes sees the use of not only inclined bed circular sawing machines for cutting of steel billets but also vertical circular sawing machines for cutting the finished pipes. If you opt for the double pack of the reliable LINSINGER symbiosis of Machine & Tool you will save yourself an entire re-sharpening centre.

The trick lies in the use of the LINCUT® disc miller with its small, highly developed cutting tips made of coated carbide. In this system, the carbide tips are not soldered but are screwed on to the base body made of tool steel. The saw teeth are operator replaceable. LINSINGER has developed a complete tool changing system for this, right from a screwdriver to a transport cart that greatly simplifies the replacement. LINSINGER has also developed special screws that ensure that the cutting plates are securely fixed on to the base body.

## 2.5 Saves sharpening centres and eliminates downtimes

At the LINCUT® system, the operating personnel can replace worn out saw teeth quickly and cost-effectively. After unmounting the saw blade, the hard metal plates can be immediately screwed on site. The transport to a re-sharpening centre or the investment in one for repair and sharpening is thus no longer required. This means lower downtimes of the machine and thus increased availability.

A circular sawing machine with a standard saw blade experiences a downtime of two percent every year due to the necessary tool replacement. The LINCUT® technology now reduces this annual downtime by half, i.e. a downtime of less than one percent.

## 3 BENEFITS AND RESULTS ACHIEVED

The table below shows the cost / benefits of applied Linsinger cutting technology of a billet saw and of a layer saw - more than half a million EUR can be saved.

Tool Cost Saving in a Seamless Tube Plant			
<b>Material</b>			<b>Material</b>
Billet Diameter	270 mm		Tube Diameter
			Wall Thickness
			Tubes/Layer
<b>Sawblade</b>			<b>Sawblade</b>
Diameter	1010 mm		Diameter
Teeth/Sawblade	60 pcs		Teeth/Sawblade
<b>Costs Standard Sawblade</b>			<b>Costs Standard Sawblade</b>
Expected Tool Lifetime	12 m <sup>2</sup>		Expected Tool Lifetime
Regrindings Sawblade	5 pcs		Regrindings Sawblade
Costs/Cut	€ 1,23		Costs/Cut
<b>Costs LINCUT</b>			<b>Costs LINCUT</b>
Expected Tool Lifetime	35 m <sup>2</sup>		Expected Tool Lifetime
Average Retoolings/Body	30 pcs		Average Retoolings/Body
Costs/Cut	€ 0,50		Costs/Cut
<b>Cost Savings</b>			<b>Cost Savings</b>
Total Cost Saving/Cut	€ 0,73		Total Cost Saving/Cut
Cost Saving in Percent	59,62%		Cost Saving in Percent
Cuts/Year	400 000 pcs		Cuts/Year
<b>Cost/Year LINCUT</b>	€ 199 105,00		<b>Cost/Year LINCUT</b>
<b>Cost/Year Standard Sawblade</b>	€ 493 034,00		<b>Cost/Year Standard Sawblade</b>
<b>Billet Saw Cost Saving/Year</b>	€ 294 000,00		<b>Layer Saw Cost Saving/Year</b>
			€ 526 000,00

Figure 3. Economical benefits of applying LINCUT in a seamless tube plant

## 3.1 The solution for Stainless Steel with circular saws

Manufacturers and processors of stainless steel parts often face the problem to fulfill the demand of small batch sizes in a short production time. The most challenging part therefore is the cutting of the raw material. No wonder if a single piece cutting times take sometimes more than one hour. To cut an order with a batch size of only 20 pieces it can already take up to 2 days. Until now, stainless steels were mainly cut with band saws, because sawing with circular saws was very difficult. Based on the extremely stable LINSINGER sawing machine and the LINCUT® side milling cutter, carbide inserts were developed especially for the application of stainless steel saws. These carbide tips enable the cutting of materials which have an unfavorable cold-forming ability and

therefore extremely poor cutting characteristics.

These hard carbide tips work so well that it is sometimes possible to go without a torrent cooling and just cut with minimum quantity of cooling liquids. In the application of cutting materials such as Duplex or Super Duplex, it is still necessary to use torrent cooling to prevent heat generation. Besides the drastic reduction of the tool costs, the biggest benefit is the reduction of the cutting time.

Below are some examples:

Material	Diameter	Band Saw (min)	Circular Saw LINCUT (min)
1.4662	420	65	13
1.4501	300	52	8
1.4542	180	18	4
1.6928	310	42	2.25
1.8523	203	26	1.15

**Figure 4.** Cutting of stainless steel with circular saws versus band saws

### 3.2 System integration with charging and discharging of products



**Figure 5.** Loading and unloading system for a Linsinger circular saw

Linsinger has vast experience in integration the saws into a loading and unloading system, either as a standalone unit or as an integrated machine, into several processing units. Also a weight

optimization can be applied by an adaptive control mechanism in order to optimize weight and length of billets, blooms or tubes.

## 4. RESULT & CONCLUSION

The new developed saw blade LINCUT®, is a patented changing system that paves the way for a fundamental reorientation of the entire saw blade industry worldwide through a simple and economical concept for rolling mills or heavy forging lines.

Cost efficiency starts with the raw material: Circular saws equipped with a standard saw blade are expected to have a necessary 2 percent standstill per year due to required tool changing. The applied LINCUT® technology, described in this paper, reduces this unnecessary loss of production by more than 50%. The ROI can therefore be reached fast which immediately lowers production costs of carbon - , stainless - or special-steel producers.

## 5. REFERENCES

- 1 Michael Steinkogler, Head of Sales at LINSINGER / Austria, at METEC 2019