

Record breaking flatbed laser cutting system unites fibre laser technology, linear motors and carbon fibre bridges

The fastest and the most precise

What do you get when a manufacturer specializing in high-end systems combines a fibre laser, a linear direct drive and a carbon fibre bridge? „The fastest and the most precise laser cutting system in the world“, according to Johannes Oswald. The managing director of Oswald Elektromotoren GmbH, initiator and pilot user of the Stiefelmayer-developed system, wouldn't accept anything less.

The good news for the rest of the world is: the blocking period for Oswald has expired so the system can now be purchased.

Up until a few days ago, this ‚Stiefelmayer effective system‘ has been under a bond of secrecy. But that is now in the past. The blocking period negotiated by Oswald for the sale to other companies has run out, allowing EuroLaser to be the first trade magazine to put this new „child prodigy“ under the microscope. First impressions: It's amazing, just how unspectacularly and calmly this system is able to handle an acceleration of 4 g's when cutting contours at speeds of 20 m/min. There's no comparison to any other systems, which begin to suffer at significantly lower levels of dynamic loading.

And yet the system can do so much more. Dieter Bulling, managing director of Stiefelmayer-Lasertechnik GmbH & Co. KG, comments on the almost inconceivable dynamics the system is capable of realising: „During drive calibration, we reached values of 10 g's, but have significantly reduced accelerations for normal operations. 10 g's really hurts anyone who has a grasp for the machinery. It's almost like driving against a wall.“ The effect of this voluntary self-restraint is both visible and perceptible, as the system presents itself as being totally shock-free and without tactile vibrations.

Moreover: Dynamics are not everything. Especially for Oswald, as manufacturer of absolute top-class electric motors, precision is equally as important. The ‚Stiefelmayer effective system‘ provides optimum values in this area, as well. Michael Mozin, assigned by Oswald as project engineer for system development, remarks: „Stiefelmayer guarantees a precision of $\pm 5/100$ mm, yet we have achieved variances of less than $\pm 3/100$ mm on all the parts we measured. And for shaft bores with 130 mm diameters, which we remeasured with a limit plug gauge, we were always at H7.“

Michael Mozin explains why such a high degree of precision on Oswald electric motors is so important: „We stack up to 1,000 laminations on top of each other and insert shafts and short-circuit bars into the stack, meaning that every single cut must be very precise. We not only need extremely accurate cuts, but we need a great many of them - actually very difficult to combine. Yet, we were able to fulfil both requirements with this ‚Stiefelmayer effective system‘.“

Accordingly, Oswald possesses the best qualifications to be able to stay ahead of the competition in the high-end electric motor market. Johannes Oswald, managing director:

The test unit from Oswald demonstrates: A fibre laser with 1 kW can cut even thicker steel plates, as well.

For Stiefelmayer, this system is the „Formula 1 machine among laser cutters“, with potential time savings of up to 25 to 30 percent in the production of complex parts.

„We start selling motors where others leave off. When it's required, we are able to build individual motors for our customers, with each one specially developed for a specific purpose.“

The laser is ideal for cutting the stator and rotor electro-laminants for such individual units, as well as for smaller units, because the overall expense for building the stamping tool, which can be very costly and take up to three months to complete, is done away with.

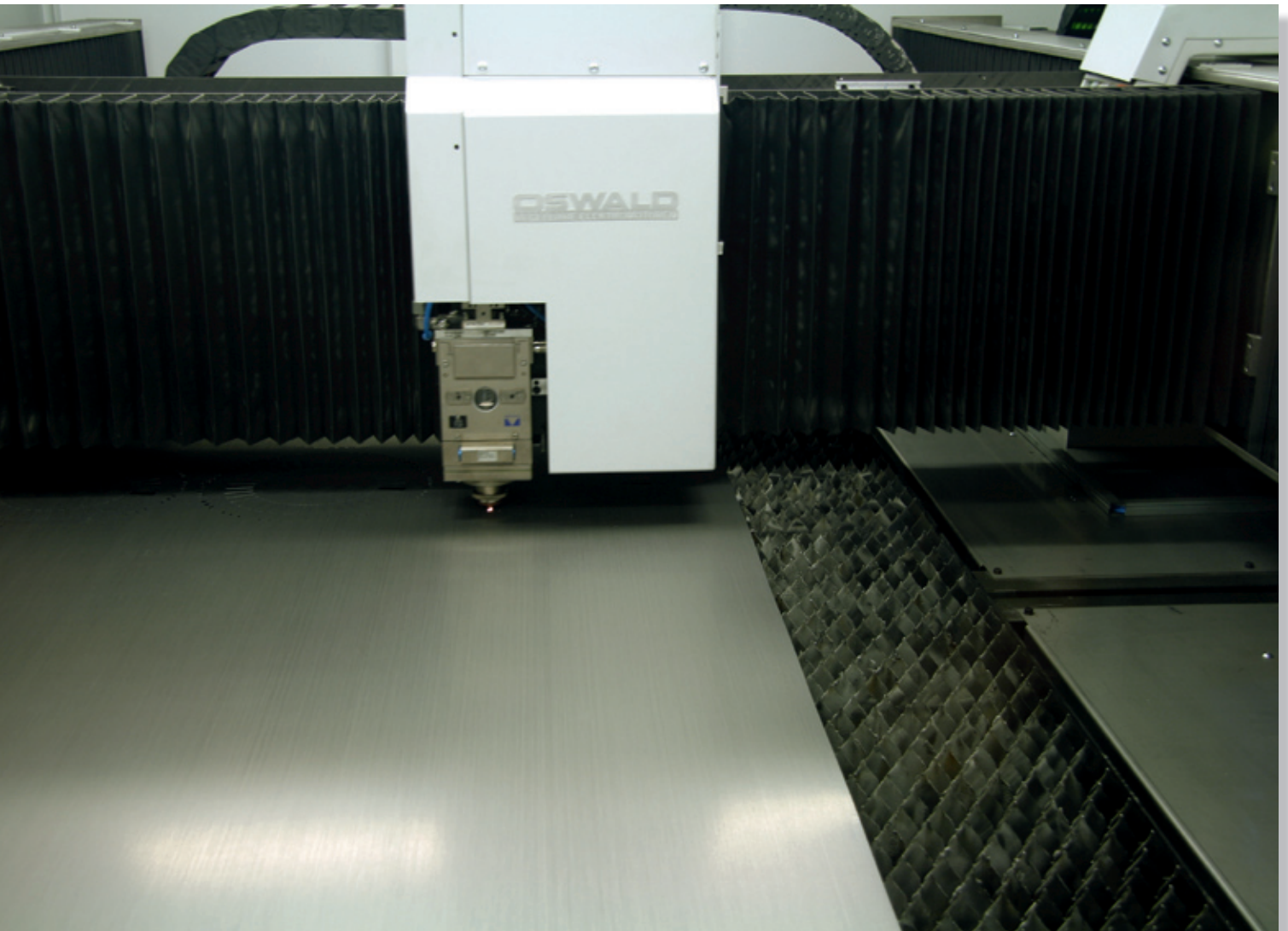
The laser also proves beneficial when developing new motors. Johannes Oswald: „Within a development context, we can now cut the electro-laminants, build and test the motor, improve its design and go on to build the next motor. In this manner, we can achieve optimum results over several steps, quickly and at a reasonable cost. We then build a stamping tool only after development has

been completed and the new development is realized for greater quantities.“

Prior to purchasing the ‚Stiefelmayer effective system‘, Oswald used specialized subcontractors for laser cutting, but this was always a thorn in the side for Johannes Oswald. „These subcontracting companies don't work for us exclusively, but also for other manufacturers. We have always been at the leading edge of this technology and a great deal of know-how goes into the cutting of contours for electric motors. We would not simply transfer this knowledge to companies accessible to other manufacturers, who would certainly be interested in obtaining it.“

In addition to this, there is the problem of time. Michael Mozin: „It always took weeks for the parts to be delivered from external laser cutters. Today, if it fits into machine utilisation scheduling, a complete package for a new motor can be finished within three days.“

The question remains open: Does it have to be a completely new, specially developed laser cutting system? Johannes Oswald: „We are a leading manufacturer of high-performance special motors. It just wouldn't be right for us to place a standard cutting machine in our facilities. We wanted something special that perfectly fulfils our requirements and, consequently, were not willing to buy an off-the-shelf



It's hard to believe just how effortlessly the ‚STIEFELMAYER effective system‘ accelerates to 4 g's in the contour and realises cutting speeds of 20 m/min.

machine.“ This attitude was confirmed by the technical demands of cutting electro-laminants, as not one of the systems available on the market was able to fulfil

the demand for precision and speed to the point of being able to justify the investment.

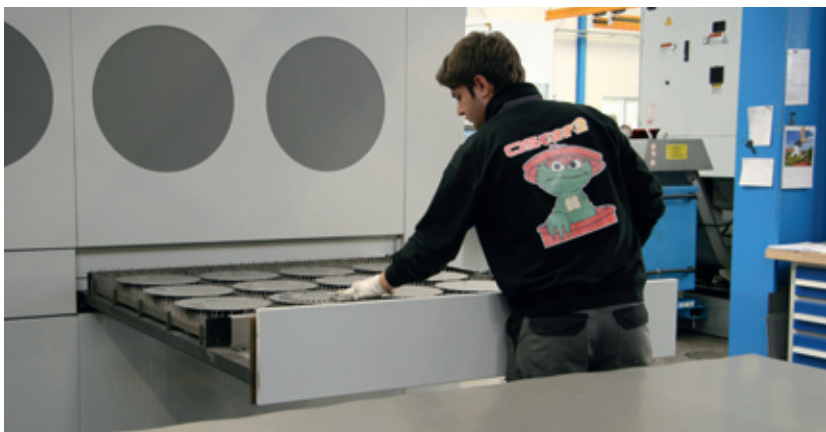
Furthermore, when Johannes Oswald was made aware of the fibre laser during his research, and as a result of many discussions with institutes and laser manufacturers, he became convinced that only the fibre laser could offer the properties needed for cutting his electro-laminants: „Fibre lasers are ideal for cutting thin plates, featuring a very high cutting quality with an extremely thin cutting gap - this is a very important criteria for us due to the exceedingly fine structures that we cut.

Also very important for us is the extremely low level of heat transfer to the material, because the electro-laminants are coated and this coating must not be damaged during the laser cutting process.“ Today it is clear: What was promised in theory, the fibre laser lived up to in practice. One point however: A flatbed laser cutting system with a fibre laser was not available in 2007.

But there was one company paying close attention to developments in this area, as well, and who ultimately had the willpower to build such a system:



For unloading, both change tables can be drawn out individually - with parallel part removal during periods of peak demand - or together



Laser cutting

Stiefelmayer-Lasertechnik. Dieter Bulling, managing director: „We were already considering building a fast, dynamic laser cutting system with fibre laser technology. Being the first manufacturer to introduce a laser cutting machine with linear motors and CO2 lasers, we had already achieved very high speeds years previously and had a basic structure to start from. We also knew where the weaknesses in CO2 laser technology were, because precision is not dependent on the machine alone, but on the overall beam guidance system.

This is where fibre lasers have a clear advantage.“

But just the integration of a fibre laser was not enough to meet Oswald’s ambitious goals.

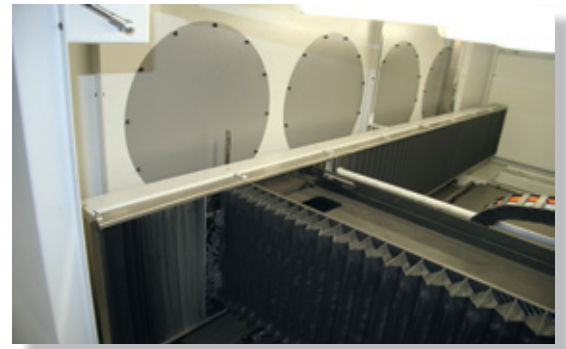
The leap in dynamic capacity needed to provide the high degree of precision and fast electro-laminant cutting speeds also demanded an extremely light cutting bridge – for Stiefelmayer, this was the starting signal for entry into the field of carbon fibre technology that Dieter Bulling had much longed for.

Then, although this was Bulling’s first professional contact with carbon fibres, he had already gained widely positive experience with the use of carbon fibres in model aircraft construction and had no inhibitions about implementing this lightweight building material, still rarely used at that time. On the contrary: „I had very good knowledge about this material for hobby purposes, having already built complete wings out of carbon fibres for model airplanes. From this positive experience base, the dream of using carbon fibre components in my profession also began to take shape. Yet, for a long time, the concrete need was not evident. This came about with the system for Oswald.“

The results speak for themselves: The basic structure of the ‚Stiefelmayer effective system’ bridge weighs merely a modest 40 kg – Dieter Bulling estimates that a comparable structure of weight-optimised lightweight sheet steel construction could easily weigh 125 kg. Diverse connecting plates also made of carbon fibre, which weigh only half as much as the common aluminium plates, are added to this. Further advantages: Due to its special construction, the carbon fibre bridge is even more rigid than the steel bridge. All these contribute to the outstanding requisites possessed for a level of dynamics that really does speak for itself. Michael Mozin: „When compared to the best competitor machines examined by us, we are 10 to 15 percent faster, and with certain fine-contoured components this can be as much as 20 percent.“



The basic structure of the bridge weighs only a modest 40kg - a comparable structure of weight-optimised light-weight sheet steel construction would weigh approx. 125 kg.



When Michael Mozin, assigned by Oswald as project engineer for system development, puts his hand on the 'Stiefelmayer effective system', he senses neither vibration nor shock, despite the high degree of dynamics.



The system is controlled by a Sinumerik 840D from Siemens, for which Stiefelmayer has developed a special user-friendly interface.



*Dieter Bulling, managing director of Stiefelmayer-Lasertechnik:
„We achieve considerably higher step speeds in the contours than with our CO2 system due to the dynamics and the fibre laser.“*

A high laser capacity is not even needed thanks to the fibre laser, as 1 kW is completely adequate for cutting the electro-laminants, which commonly come in thicknesses of 0.5 mm or less. Dieter Bulling: „We achieve considerably higher step speeds in the contours than with our CO2 system due to the dynamics and the fibre laser.“ A CO2 laser with approx. 3 kW typically realises a step speed of 10 to 12 m/min with electro-laminants. With the 1 kW fibre laser, however, Oswald cuts 20 m/min and has even reached 22 m/min with high process accuracy.“ This also explains the significantly lower heat transfer. Michael Mozin:

„With only 1 kW instead of 3 kW, and then at double the speed; this naturally has a direct impact on reducing heat transfer.“

Yet, there were other reasons why Oswald still considered raising the capacity of the laser, as well: While Johannes Oswald and Michael Mozin did not want to elaborate on the subject, this much is clear: One beam source can supply more than one processing station and there are enough things that can

be done with a fibre laser that demand more than 1 kW. This is not a problem for the fibre laser because, in this case, additional laser modules would simply be inserted, then bundled and directed to the working laser via a combiner.

Back to laser cutting: The 'Stiefelmayer effective system' can also take credit for providing significant energy saving benefits - and thereby giving credit to its name. In order to obtain exact values, Michael Mozin even measured the power consumption of his laser cutting system under differing operating conditions. With impressive results: Maximum demand - 13.5 kW. Dieter Bulling estimates that a comparable system with a 2.5 to 3 kW CO2 laser would need around 35 kW installed power for the laser and a further 20 kW for cooling - not even considering the machine's drive units.

Considering the many advantages, it's no wonder that Oswald's resume of the 'Stiefelmayer effective system' is a positive one. For Johannes Oswald, one thing is certain: „This was the right decision.“ An assessment that Michael Mozin can fully and completely confirm, despite a few slight problems at the start: „Of course there were a few difficulties to deal with at the beginning. After all, we were entering new territory in several areas. But as soon as a problem arose, Stiefelmayer personnel were there to rectify it the next day. In the meantime, the system is running trouble-free.“

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www.stiefelmayer.de

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