

Milling and grinding with one VERSA 645 linear High-precision milling technology combined with the features of coordinate and contour grinding

# Milling and grinding center unites economy and precision

by Manfred Lerch

The requirements for economical and precise production and, therefore, high process reliability continue to increase. In this context, Fehlmann AG is presenting a concept that combines milling, hard milling and coordinate grinding in one machining center for the first time at EMO 2019. This is a concept that impresses through economy, precision and simple programming.

Coordinate grinding or hard milling? Numerous companies are faced with this decision when it comes to high precision and surface qualities. When coordinate grinding meets high quality requirements, it is considered a difficult, complex and cost-intensive process. Hard milling, on the other hand, scores points with its economical removal rate, both during roughing and finishing. A combination of both processes on one machining center would drastically reduce machining time, as only one clamping is need-ed. Also, this would allow for highly precise finishing and provide for increased process reliability, as the contours are already known.

Fehlmann AG has more than 20 years of know-how in coordinate grinding and has already configured customer-specific systems as an option. However, due to an increase in inquiries from tool and mould makers, as well as from parts producers, a joint project between Fehlmann AG and Heidenhain has now developed a solution that sets the requirements for a new standard.



The mounted point is located in the rotational center of the spindle and executes the oscillating movement.

The company already created the basis for this in 2016 with the 5-axis machining center VERSA 645 linear.

The VERSA 645 linear was chosen for the new concept (also by Heidenhain) because, thanks to the highly dynamic axes, the already existing machine dynamics and precision guarantee that nothing had to be changed in terms of machine technology.

In addition, this machine concept possesses all of the basic prerequisites for combining these processes in a single machining center: high basic mechanical accuracy, solid construction, thermal stability and low thermal growth. This means that the accuracy of the machine can actually be transferred to the workpiece.

At the same time, the VERSA 645 linear covers a very wide range of applications. Due to the high contour accuracy of the machine and controls, a U-axis is not needed. The in-feed during grinding is affected by the path control. The grinding wheel is located in the rotational center of the spindle. The basis of the VERSA 645 linear is the combination of these processes on one machining center: high fundamental mechanical accuracy, solid construction as well as thermal stability and low thermal growth.



During contour machining, the Z-axis executes an oscillating movement super imposed on the contour. A pendulum stroke generator was developed for this purpose.

Urs Schmid, Head of Development, sees the greatest challenge for the new development in the dressing function, which is indispensable for the best surface qualities: "For the new control system, this means that an additional spindle had to be integrated into the machine kinematics." The dressing spindle (3,000-20,000 rpm) is located at the swiveling bridge, is liquid-cooled and equipped with a structure-borne sound sensor. The dressing process is the same as on a grinding machine.



Urs Schmid (li.) and Frank Fehlmann (re.): "This project was strongly pushed by us because demands on the users are constantly increasing, materials are increasingly difficult to process and we view it as our duty to help our customers be competitive."



This dressing spindle can be swiveled, therefore not restricting the 5-axis machining area.

It is adjusted once, the disc grinds the first diameter with the radius correction and the rest runs automatically in the background.

The programming of the dressing with about 30 parameters is considered to be very complex. Therefore, Fehlmann has developed superimposed cycles that contain only the most vital parameters, simplify programming considerably and are preconfigured on the VERSA 645 linear. This means that contours can be programmed easily and without any problems, just like during milling. With its first workpieces, Fehlmann demonstrates how economically and precisely this new concept works: For example, a diameter of 30.499 mm with a deviation of -0.001 mm was achieved for a  $\emptyset$  30.5 hole. For a matrix with a 35 mm deep outer contour, the surface finish was carried out with slow stroke grinding and a surface roughness of Ra 0.16 is achieved.

To sum up, with this new concept, Fehlmann AG has created a combination of hard milling and grinding in one machine, with which bore holes, contours and guides made of steel, ceramic and hard metal can be milled and finished, without re-clamping, using coordinate grinding.

# THE ADVANTAGES OF COMBINING HARD MILLING AND GRINDING ON VERSA 645 LINEAR

- High efficiency, short throughput times, because milling is many times faster, no re-clamping required
- Increased efficiency through high process reliability
- Simple programming with cycles
- High accuracy on the workpiece due to high machine accuracy
- High process reliability due to high repeatability
- Top surface finish through integration of dressing spindle into the machine

With its first workpieces, Fehlmann demonstrates milling and coordinate grinding on one machine, and how economically and precisely this new concept works.

## **CONTACT / INFORMATIONS**

Fehlmann AG Maschinenfabrik CH-5703 Seon / Switzerland Phone +41 62 769 11 11 www.fehlmann.com mail@fehlmann.com

Your Precision Advantage.®



### Fehlmann AG Maschinenfabrik

Birren 1 - 5703 Seon / Switzerland Phone +41 62 769 11 11 mail@fehlmann.com - www.fehlmann.com