

About the improvement of Samputensili Shaving Cutter Grinding Machine mod. S 400 GS

Optimizing the Samputensili S 400 GS shaving cutter grinding machine any further may seem a difficult, if not impossible, task to many. Following the latest feats in engineering, however, a new NC-controlled axis has been integrated on the work holding assembly to move shaving cutters axially in relation to their own bores.

A slide, equipped with high-precision, preloaded roller guides and a top quality recirculating ball screw, has in fact been incorporated on the traverse carriage (axis B) and makes workpiece axial movement possible by reciprocating orthogonally in relation to the traverse carriage itself.

Linear motion is actuated by a 1 N/m torque brushless motor whilst a Heidenhain optical linear scale, with a micrometric resolution to the thousandth, guarantees correct axial positioning.

The required axial position is maintained, on the other hand, by a hydraulic brake, which is managed by the same hydraulic unit used to brake all machine axes. Naturally all machine functions and coordination of the new axis with the profile generation axes are managed by a Siemens 840D numeric control unit.

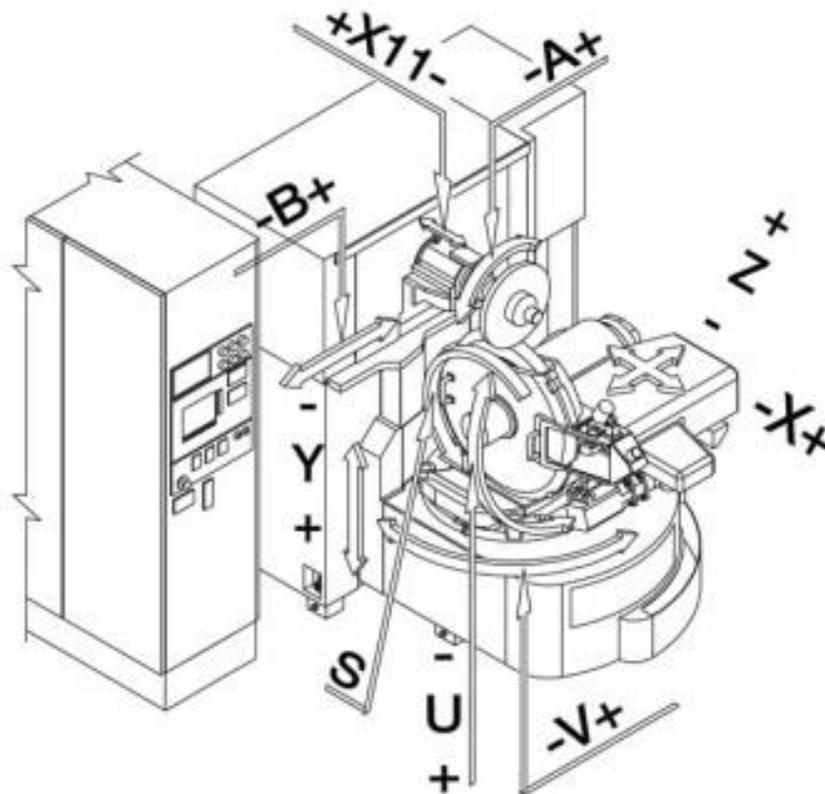


Fig. N°1- Axes scheme of S400GS Shaving cutter grinding machine

Engineered with 9 controlled axes, no other machine available on the market today can rival this solution. Indeed, integrating this additional axis will instantly bring customers a series of advantages, which may be summarized as follows:

No more rear mechanical spacers = greater precision

Now that the workpiece can be moved in relation to the axis which theoretically passes through the centre of the work spindle, rear mechanical spacers, previously essential for correctly centering the shaving cutter with the grinding wheel, are a thing of the past, and benefits for the user are twofold. Firstly, planar positioning of the shaving cutter is much more accurate and accumulated errors caused by the mechanical construction tolerances of each spacer are no longer a problem. Secondly, total precision is guaranteed when it comes to locating the exact centre of the shaving cutter tooth, the point over which the maximum outside diameter of the grinding wheel has to pass. Without rear mechanical spacers, it is no longer necessary to compromise on quality as was the case when the total sum of spacer thicknesses available did not equal the theoretical thickness required for perfect centering. The new axis, named X11, hence makes machine set up faster and the required profile is not only easier to generate but accuracy is guaranteed. This is even more true if tools with correct leads and involutes are utilized. Test results in fact show that machine set up times, in particular time spent setting up the machine to generate the desired profile, decrease by around 30% with this new solution. Possibility to grind also high precision master gears.

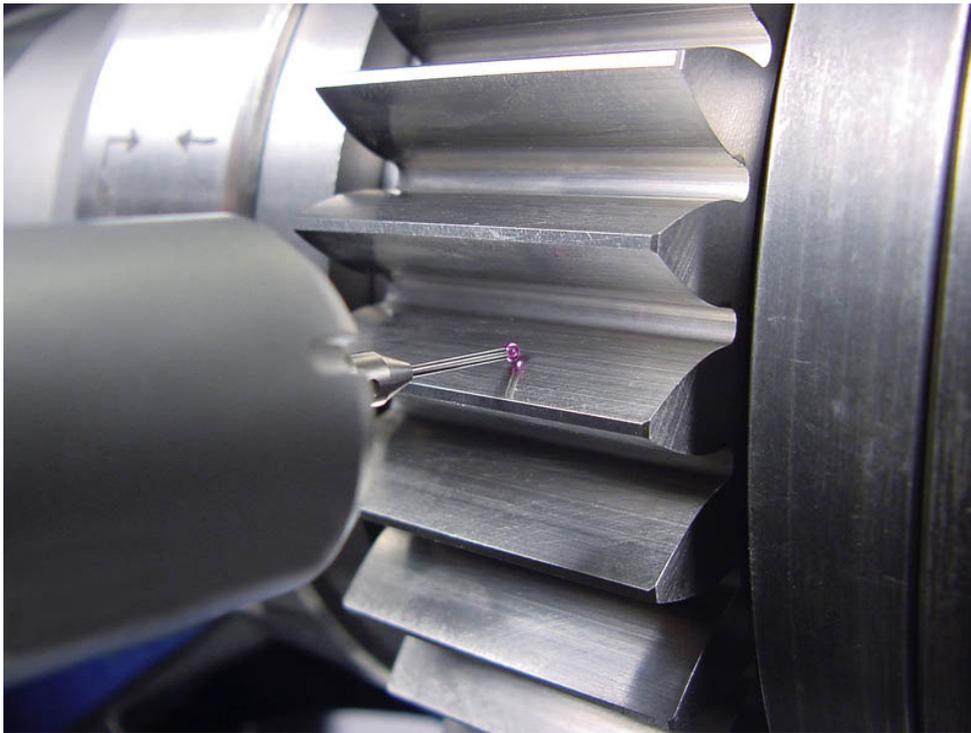


Fig. N°2- Large face width master gear checked on-machine

Simplified control system = greater reliability and lower costs

Adding the X11 axis has also enabled us to streamline the on-machine workpiece control system. Previously this system consisted in a pneumatic arm, mounted on an NC-controlled guide, which enabled the probe to move along the whole tooth profile. The new solution, however, makes use of a pneumatic probe arm which is fixed at the base and can therefore only perform an angular stroke of 90°. Control of the whole tooth length is thus guaranteed by the controlled movement of the new X11 axis. Radial and rotary

interpolation, which is required to control the involute, remains just as in the former machine version, and is performed by the B and A axes. With the new X11 axis, users will find machine control options even more attractive as a simplified control system means lower costs.

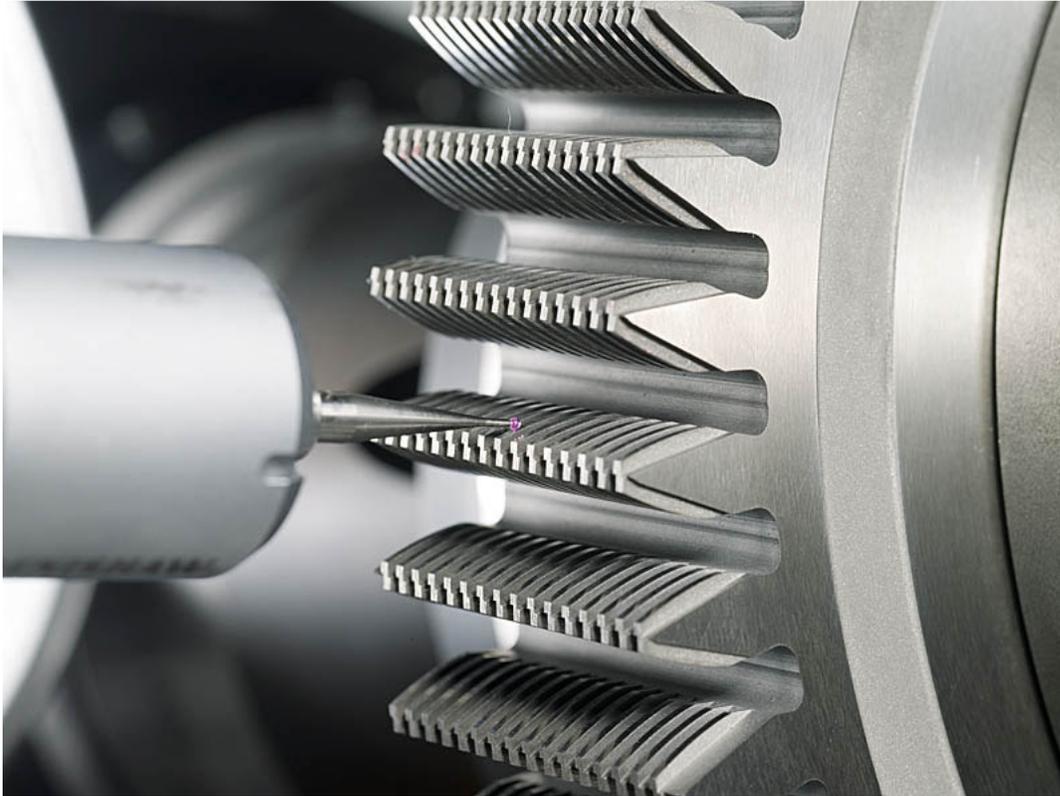


Fig. N°3- *On machine workpiece control*

Grinding of workpieces with large face widths = greater application flexibility

Obtaining a correct profile along the whole tooth length of tools with large face widths is one of the most lamented limitations of using machines with fixed-position grinding wheels. Using large diameter grinding wheels (760 mm) can in fact only reduce tooth profile errors to a certain extent. Until now, it was practically impossible to grind workpieces with face widths of 70 mm, without compromising on the quality of the generated profile towards the edges of the toothed face width. Thanks, however, to the new axial movement of shaving cutters with the X11 axis and to special Samputensili S 400 GS software, it is now possible to grind workpieces with face widths up to 70 mm, obtaining a correct profile in all points and not just in a precise central area of the tooth. Clearly, this means tool users, and especially users of shaving cutters, will be able to fully exploit the advantages of large face width workpieces such as in diagonal shaving, for example, where it is possible to execute longer strokes and distribute the cutting force over a larger number of teeth, hence reducing wear and increasing tool life span.

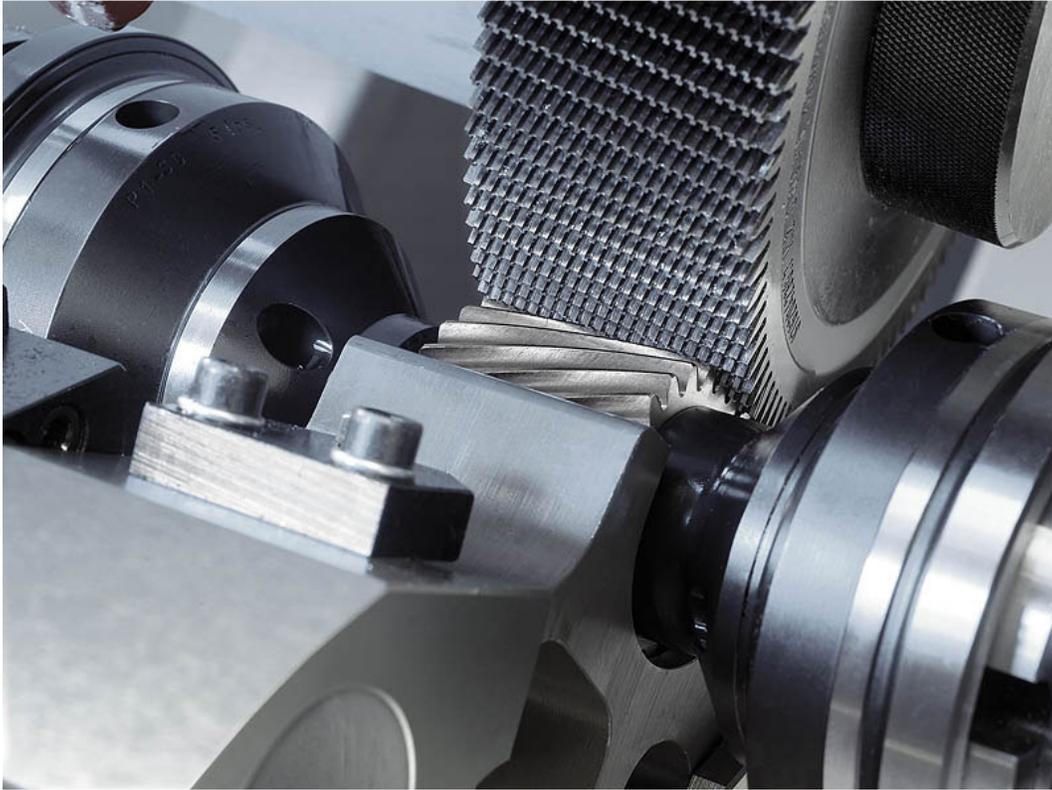


Fig. N°4- Large face width shaving cutter