

# Not all at once!

## New grinding process for increased productivity

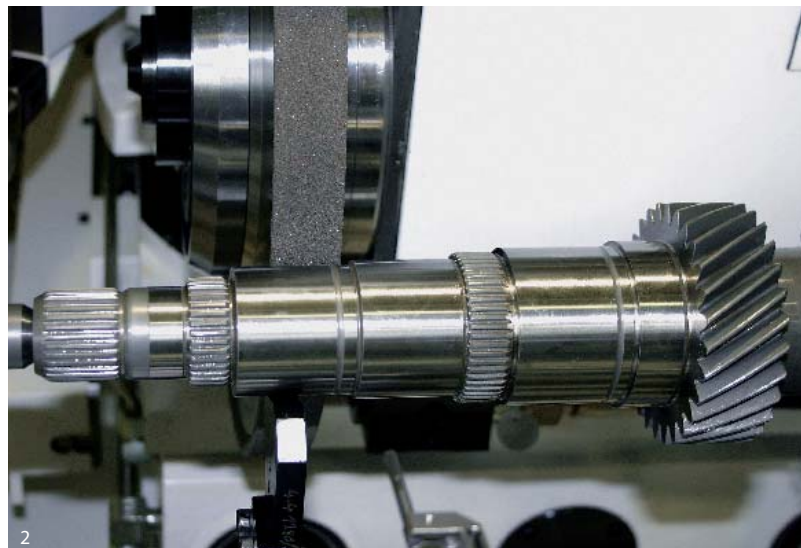
The automobiles produced by Mercedes-Benz are considered by many to be the best in the world. Because such an image cannot be maintained solely on past achievements, quality improvements are constantly in the works. And because quality generates demand, the quantities also increase. This applies both to the parts that have been working behind the scenes for their entire service-life and for the machines that process them.

The Mercedes, or rather, Daimler-Chrysler plant in Gaggenau is the oldest still existing automobile plant in the world. It was founded in 1894 on the edge of what was then a small town and was taken over by Benz & Cie in 1907. Gaggenau is still not a major metropolis, but it has grown considerably and the plant is now practically in the center of town and it has no room for expansion in its original location. That is why the transmission plant was put into operation in Rastatt in the 70's. This site provides around 227,000 m<sup>2</sup> of plant space. In Gaggenau there is approximately 412,000 – together with a third site in Bad Rotenfels, the two sites offer barely 190,000 m<sup>2</sup> of space that is purely for production. In Rastatt alone, approximately 2,000 employees work for the Daimler-Chrysler utility vehicle division, almost 200 of whom are trainees.

### A half million transmissions per year

For the first 100 years at the Gaggenau/Rastatt site, utility vehicles were in the forefront. This changed with the introduction of the 2nd generation of the A-class, which is built in Rastatt. Since then, drive components for passenger cars make up a considerable share of the production in the Rastatt transmission plant. In 2005, a record year, 1,085,000 torque converters, 492,000 transmissions and 81,300 planetary hubs were produced – quantities that don't allow for long downtimes. Not only the employees, but also the machines and their manufacturers have to be extremely reliable. But, more about that later.

For the introduction of 6-speed standard transmissions for the A and B classes (front-wheel drive), V class, Sprinter and some Chrysler types (rear-wheel drive), new pro-



duction capacities had to be created. "We started with 170,000 transmissions per year and by 2008 we expect that number to be 500,000," says Alexander Hatz, responsible for the process planning for transmissions and light series shafts, as he illustrates the rapidly growing need of his plant.

Among other things, new machines had to be procured for the external cylindrical grinding of shafts. In 2002, the persons in charge of production planning at Daimler-Chrysler contacted JUNKER, a manufacturer of grinding machines, to discuss their requirements:

- nine different, defined parts
- complete grinding (plane surfaces and outside surfaces, recesses) in one clamping operation
- high degree of flexibility of the production process (part sizes and modifications, batch sizes, etc.)
- Short setup times

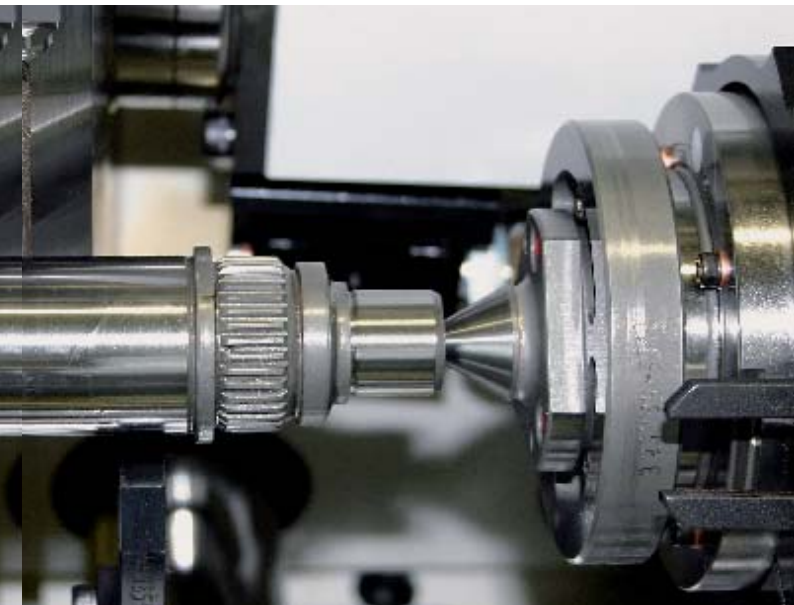
- high degree of availability
- grinding under oil (such as for gear-teeth grinding; a central system)

The increased flexibility was particularly important, because the number of variants almost doubled due to the new generations of transmissions and the new 'customers' (new V class, new Sprinter, Chrysler).

### Serial instead of parallel

After various concepts had been examined (only two suppliers were able to even meet the demands), the QUICKPOINT 3000/60 was the most convincing, and only JUNKER was able to show the relevant experience: a machine with three independent grinding spindles in the B axis and seven to eight grinding wheels that engage sequentially (controlled by the CNC) and completely grind the part in one clamping operation.

The alternative would have been to use two clamping operations as was previously done



for the 5-speed transmission grinding wheel package and which was able to machine several surfaces simultaneously. To be sure, that would have decreased the machining times somewhat, but it would have meant multiple setup times and a corresponding drop in productivity and above all flexibility. The setup times have been reduced from several hours (for the old corundum wheel sets) to approximately a quarter of an hour. The goal is nine minutes. Wheel changes are no longer required between many groups of parts. Thus, several batch changes per day can be handled with ease, which means that it isn't necessary to build up large in-transit storage areas at any location.

But these advantages could only be 'theorized about' in 2002. First, JUNKER would have to test various grinding equipment and processes. The optimal solution ultimately proved to be ceramically bonded CBN for the outside surfaces and galvanically bonded ☒

1 Plunge-cut grinding with CBN grinding wheel on grinding spindle

2 External cylindrical grinding and plane shoulder grinding of the seats of the shaft in one clamping in the JUNKER high-speed grinding procedure with a CBN grinding wheel on grinding spindle 3

3 Grinding recesses with radiuses on main shafts with CBN multiple grinding wheels on grinding spindle 2 in the CNC swivel grinding spindle headstock (B axis)

CBN for the plane surfaces. This made it clear that it was possible to gain more advantages all at once using this procedure, namely:

- n significantly increased flexibility
- n increased accuracy
- n faster throughput (machining times, setup times and idle periods)
- n simplified logistics

### The godfather takes care of everything

Now it was a matter of optimizing the processes as much as possible in advance. To this end, a joint workshop was conducted as early as the project phase. Then JUNKER provided two leased machines to allow a smooth start

and to shorten the learning phase. A new process can hardly be introduced without initial difficulties. „In spite of the difficult circumstances, the technological problems were quickly solved thanks to the high degree of operational readiness,” says Alexander Hatz in praise of the JUNKER team. The geographical proximity is certainly an advantage, but definitely not the most important one. It is more important that JUNKER is an extremely reliable partner with qualified personnel.

Continuity is also provided: Each machine, and if possible, each customer has a ‚godfather‘ that remains for the entire life-span of the machine.



1 „Under the Laburnum“: Frank Müller (l.) from JUNKER and Alexander Hatz from the Daimler-Chrysler transmissions plant

2 JUNKER QUICKPOINT 3000 with parts storage unit (behind the car) and automatic part feeding and removal

## JUNKER QUICKPOINT

With a CNC swivel grinding spindle headstock with three grinding spindles and several grinding wheels, the QUICKPOINT 3000 demonstrates the automated complete grinding through operations: external cylindrical grinding, plane shoulder grinding, radius grinding, recess grinding and plunge-cut grinding. With three platforms and five grinding spindle headstock combinations, the QUICKPOINT series of machines opens external cylindrical solutions for practically every use: from the compact QUICKPOINT 1 for small components and the QUICKPOINT 4 (previously QUICKPOINT 3000), to the QUICKPOINT 6S and 6L for large components. The typical workpieces are gear shafts, drive shafts, cam shafts, engine valves and pump shafts. Almost all materials can be machined: Steel, aluminum, carbide metal, industrial ceramic, sintered materials, plastic, glass. Individually, manual, semi-automatic and fully automatic loading systems can be modularly docked to any model from the QUICKPOINT series.

By now, the savings compared to competing processes had to be numeralized. Thus, using galvanically bonded CBN, it was possible to exactly halve the tool costs for machining the plane surfaces compared to hard turning (a well-received, stable process). The high number of pieces machined between resharpenings also contributes to this: In any case, 20,000 shafts can be grinded with a CBN wheel.

### Availability around 99 percent

Everyone was waiting to find out how stable and how reliably the CBN grinding would run on the QUICKPOINT 3000/60. Now, the requirement from the requirements specification of 95 percent was clearly exceeded: The ‚Prisma‘ system documented a technical availability of around 99 percent – further proof that this was the right decision.

Nothing now stood in the way of delivering the new grinding machines. The first machine was delivered in October of 2003, the second was delivered in November; the fifth and last (for now) were delivered in April, 2005.

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