

KOEPVERN

Complex large components machined with high precision.
Boring and milling centre for the production of roller presses



When the manufacture of hard coal briquettes was developing into an industrial process towards the end of the 19th century, mining company director Wilhelm Köppern purchased the “Berninghaus smelter” in Hattingen on the Ruhr in 1898 to build roller presses for briquette production there. He refined the original Belgian design of those presses. That is how target-oriented innovation brought about the success of Köppern – a family-run Group – and it continues to do so to this day. Today, Köppern manufactures modern, high-tech products in the form of machines and systems, for a range of different treatment processes. Köppern roller presses are widely used across a number of industries, for example for the comminution of clinker and slag for cement production and of a variety of ores and minerals, including iron ore, gold, copper, nickel, bauxite, vanadium, molybdenum and diamondiferous ore. Köppern machines work on the basic principle of two counter-rotating rollers. Image 1 shows a high-pressure grinding roll for high-pressure comminution of ores. In total,

Köppern has already sold several hundred roller presses in more than 60 countries for briquetting, compaction and comminution. In the company’s own pilot plants processing of more than 2000 different materials has already been tested.

Seventeen years ago, the Köppern Group built a new plant on the new Hattingen industrial estate on the river Ruhr, opposite from the old factory site, to be equipped with suitably modern equipment for efficient and reliable high-quality production and assembly of its own products. One of those machines was a SPEEDRAM floor type horizontal boring mill from the Italian company PAMA. The original intent of the new project was to retrofit the existing Pama machine to bring it up to modern components and a higher performance. However, it soon became apparent that it was not worth the cost measured against the technological advantages of an entirely new machine. “What is more,” stresses Jörg Ehrkamp, authorised representative and Head of Production and IT, “with a new machine, you are simply bet-

ter prepared for the requirements of production of future components. That is why we decided to purchase a new machine.”

Trust in PAMA technology

“Over the almost 16-year period that our first PAMA machine was in operation,” says Production Manager Bodo Struck “we did not just come to appreciate the quality of the machine, but also built up excellent personal relationships with the PAMA employees. We knew that PAMA, with its expertise in manufacturing, production and assembly, would be able to meet our technical and scheduling needs. To begin with, we had to find out whether the new machine, configured as we required, could be placed on the foundation of the old machine. The result was that the foundation could bear all the loads of the new machine and it was also geometrically suited to it.” “PAMA’s task”, explains Thomas Ulrich, Branch Manager of PAMA GmbH in Mainz, “was to produce a modified X Axis bed for the new machine, designed to fit perfectly onto the locators already in place



in the existing foundation. In addition, we kept the old machine's 3 x 5 m floor plate area. That meant that the new machine could not be assembled as normal, but had to be aligned to the existing floor plate. The excellent cooperation during assembly and commissioning was remarkable. The on-site Maschinenfabrik Köppern employees assisted us, with the result that the assembly and commissioning work was completed within just nine weeks, rather than the usual 12, and the machine could quickly be incorporated into the production process." Bodo Struck adds, "The same PAMA project manager worked with us from the beginning stage right through to completion of the commissioning work. That guaranteed an excellent level of support, which eliminated any gaps in communication."

SPEEDRAM 2000 as requested by the customer

The configuration and order of the PAMA-SPEEDRAM 2000 machine was based on the morphology and material properties of the components currently being processed and forecast of future manufacturing tasks. "At the moment for example," Bodo Struck explains, "we use the SPEEDRAM 2000 to manufacture bearing housings, cover plates, frame straps, foot plates, motor consoles and large bands which are mounted on the roller core, and also to pick up the equipment needed for the comminution. As a rule, the materials we use are special materials, which are always heat resistant, high strength and/or very tough. That is why we bought a machine which is characterised by high rigidity and features vibration damping."

The existing floor plate and a rotary table model TH 50 with a hydrostatic supported V axis with 1500 mm of stroke, are used to set up the workpieces. The rotary table has a plate dimension of 2500 x 2500 mm and a net load capacity of 50 t. allowing for set up of even our largest components.

The machine column moves on a 9000 mm long X axis. That enables it to reach the rotary table, the floor plate area and the head storage station installed to the right of it. The headstock vertical travel is 4000 mm. To be able to get deep into the parts, the ram can be extended by 1200 mm and the quill an additional 1000 mm. To achieve high productivity, the PAMA SPEEDRAM 2000 is fitted with a 93 kW motor, which drives the

150 mm spindle using a three-speed gearbox. Another features driving productivity up is the feed rate, up to 20 m/min in all axes. High performance machining of special hard steel requires adequate protection against flying chips or tool breakage. PAMA designed and installed an extra high enclosure. Operator access for machine maintenance or part clamping process is controlled by the operators and can happen at their leisure.

An extra-large operator's cabin – as requested – is another feature of the user-friendly design. To support the operator in their high responsibility work, this cabin is air-conditioned. "We process extremely valuable components," stresses Bodo Struck. That is why, despite automatic operation, the machining process is closely monitored. The independent operator platform can be moved up or down, or even forward in the direction of the spindle, regardless of the headstock movement."

Accessibility of the machining surfaces

In addition to the machine axes, automatic interchangeable milling heads make machining the internal and side surfaces accessible in a short time.

An automatic right angle milling head, model TS 35 360, an automatic 3+2 universal milling head which can be adjusted to 0.001° on each axis, model TU 25 C, a compact right angle milling head, TS 20 144, and the cover

frame are stored in the head storage unit. The right angle milling heads enable five side machining in a single set up. "Conveniently," says Bodo Struck, "PAMA also designs and produces the heads attachments. That means that they match the supplied machines perfectly." Following a specific procedure, the ram retrieves whichever milling head is needed from the storage unit.

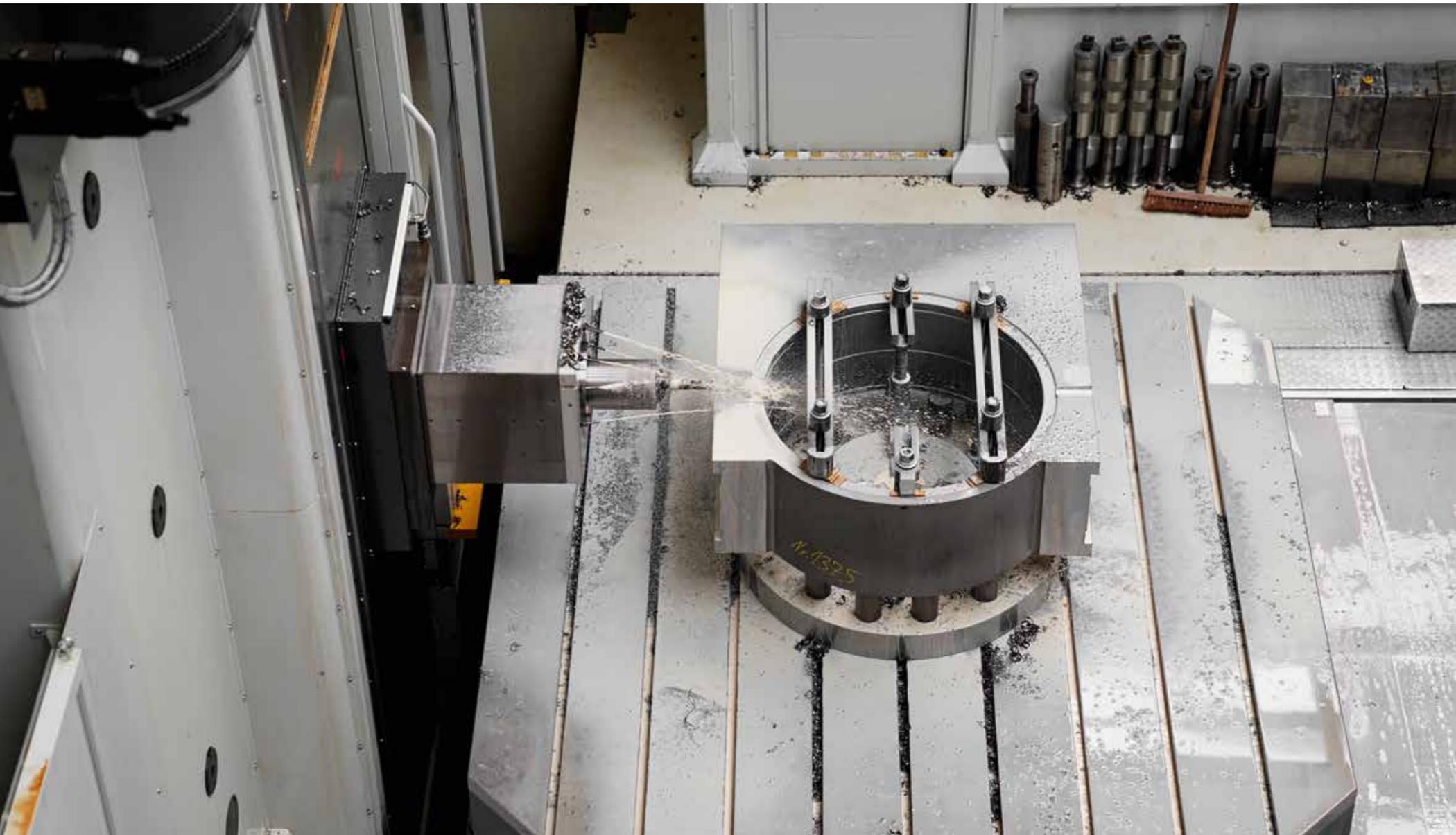
Tools are changed out of the chain style magazine by an automatic tool changer. The ATC is mounted on a tilting mechanism to allow automatic tool change both horizontally in the spindle and vertically in the heads. All tools required for machining are stored in the magazine, which has a total of 120 pockets. For oversize tools of up to 1200 mm in length (ISO 50), a six position tool rack is installed on the head storage unit. "The tools required for each program," explains Bodo Struck, "are placed on the chain magazine's swapping station in the manufacturing process. Via the input panel, the controller receives the current data on the assignment of the tool magazine. We have to input data manually in order to eliminate mix-ups. We use the tools in different machines."

For boring, PAMA supplied a CNC-controlled facing head, model UT 5-800 S, with tool holder CAPTO C6.

Achieving machining accuracy

"Our parts are machined to an H6 tolerance in accordance with their accuracy require-





ments” explains machine operator Wolfgang Schweinert “This requires not just a rigid machine construction of all load-bearing components, but also accurate movement along all axes. It also involves precise manufacturing preparation.”

“We manufacture according to order,” stresses Jörg Ehrkamp, and he explains, “Given the size of our machines and customer requests, we manufacture batch sizes 1 to 2. The finalised 3D drawings are transferred from our design department to the manufacturing engineers, who use them to draw up the part programs. Conveniently, their office is located right next to the mechanical production department. That means that information can be exchanged quickly and easily.”

Once the machining program is loaded on to the machine control system, the operator can add any optimisations that are still needed using the Sinumerik 840 D control panel. From a mechanical point of view, precision manufacturing is based on two

things: Firstly, the workpiece must be solidly clamped to prevent vibration, and secondly, the SPEEDRAM 2000 must be set up to minimize tool vibrations during machining. “On the basis of construction principles typical to PAMA,- Thomas Ulrich explains - To achieve that, our machines are produced exclusively from cast components and all axes have integral hydrostatic support. That is true not only for all linear axes, but also for the rotary table. The ram is also hydrostatically supported on all four sides. Moreover, the quill operates with hydrostatic support (HSS Hydrostatic Sliding Spindle). Hydraulic tension rods offset the ram droop. In addition, the machine compensates thermal expansion of the ram and quill in real time via a Pama patented system. For thermostabilisation of the headstock and hydrostatic oil, the PAMA SPEEDRAM 2000 has a chiller.

The internal coolant supply protects the tool cutting edges and flushes out the chips. For deep drilling process, the machine is provided with quick connection for an ejector drill

on the headstock. That way, high volume coolant can be provided to the drill bit at up to 50 l/min. The heat dissipation protects both the drill bit and the spindle.

Of course, the coolant is more effective with cleaning and recooling. To filter the cooling lubricants, Köppern uses a self cleaning drum filter with its own backwashing. “We have had good experiences with it,” says Jörg Ehrkamp, but he also stresses that regular rinsing of the chip conveyor is necessary. At this point, Bodo Struck concludes by pointing out a further advantage of the new PAMA machine: “The ancillaries such as the chiller and pumps are much quieter than those on the old machine.”

It is also worth mentioning PAMA’s software package ‘Pama Maintenance Program’ (PMP), which monitors all the head attachments and machine assemblies with regards to their service life, and any maintenance due in connection with this. This enables the user to check the machine’s maintenance conditions at a glance.

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