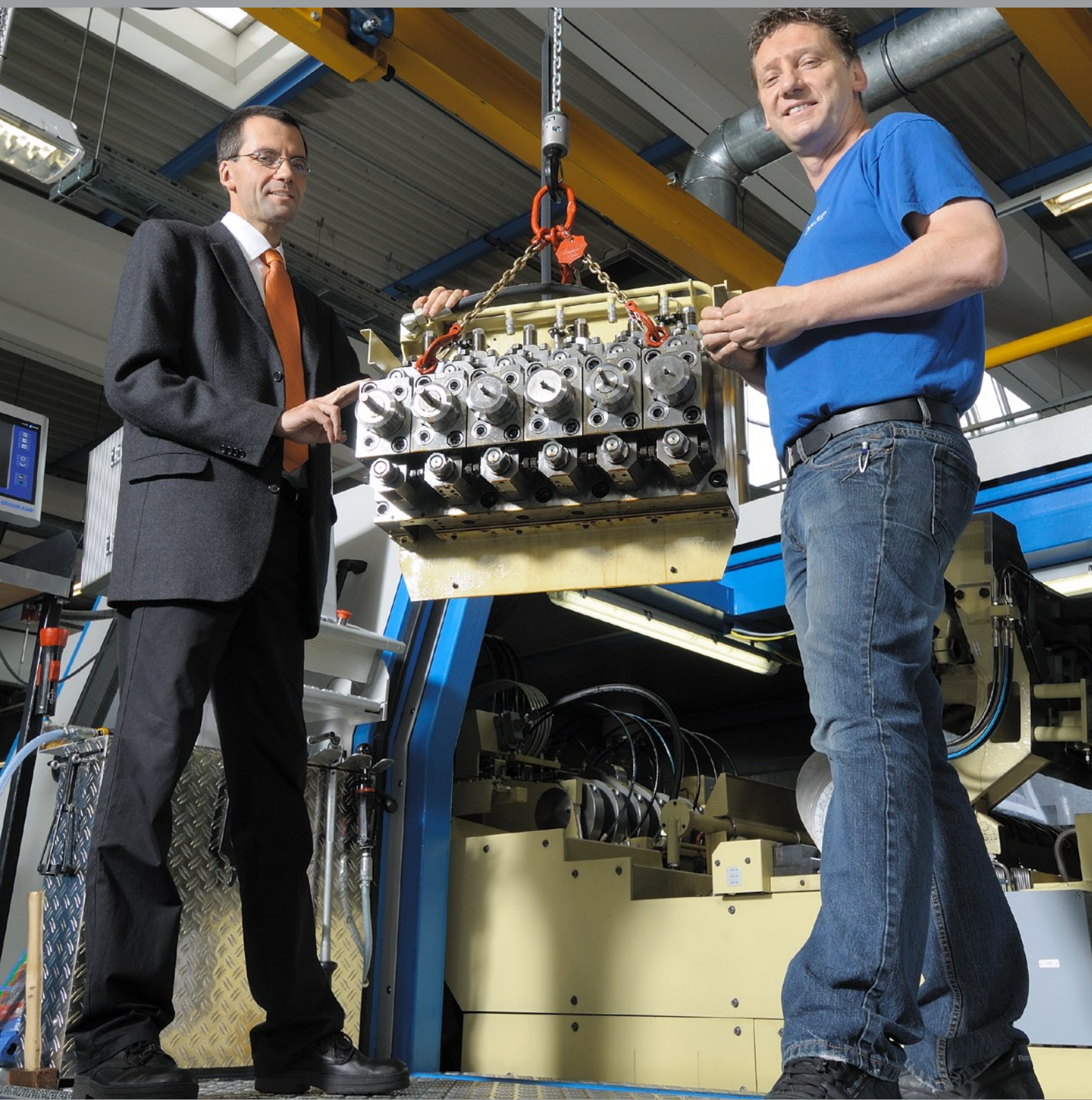
NETSHAPE

Hatebur magazine for horizontal cold and hot forming – **2/08**



ARNOLD UMFORMTECHNIK: Onwards and upwards with the Coldmatic AKP 4-6 S

EDITORIAL

DEAR READERS,

This issue of "Netshape" once again takes a look at the views of our clients and procedures conducted within our corporation. We show examples of the various developments adopted. Our aim is to offer our customers expert and comprehensive advice that we have obtained by "installing Hatebur machines all over the world". Based on our core skills as an engineering and machine manufacturer and complete installation planners, we will do everything we can to support our clients throughout the life of our machines, enabling our customers to benefit from our expertise and service with constant expansion of our capabilities. For example, we are expanding different areas of service to strenghten the range and impact of our capabilities. Our latest addition in helping better serve our customers is the engineering of our "new" mobile machine unit for rebuilding of Hatebur forming machines.

What is the use of a production unit without tools or a succesful process? What we strive to do at Hatebur, and must do, is to offer economical tool solutions and processes for a variety of opportunities encompassing a wide range of temperatures. This type of technology is supported by our computer simulation department along with software developed by Hatebur demonstrating the kinematics of our machines. This is where we can bring our experience and capabilities of our machines to you as the customer.

The articles that follow provide a more detailed description and some of the possibilities offered. I trust you will find them of interest.

Andreas Matt, Technical Director

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Cover picture:
Uwe Fleckenstein (left) and Gerd Pfeiffer of Arnold Umformtechnik.

IMPRINT

NETSHAPE – Hatebur magazine for horizontal cold and hot forming

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NEW FILM STARS COLDMATIC AKP 4-6 S

Following the successful filming of the Hatebur Hotmatic HM 35, our newest hotformer, it was then time for the Hatebur Coldmatic AKP 4-6 S in September. This video was conducted in our research center, located here in Reinach, where the machine has been recently restalled. A professional film crew was hired to show the coldformer in exactly the right light. As previously with the HM 35, a high-speed camera was used to video the machine in production. It can produce ultra-slow motion images of superb quality.

Left:
director Peter Beck (2nd right) at work with his film crew.

Right:
high-speed camera in the tool room of the AKP 4-6 S.

NEW ADDITION TO RESEARCH CENTER: THE AKP 3-5

Following the installation of the Hatebur Coldmatic AKP 4-6 S in the spring of 2008, we now implemented the AKP 3-5 into our research center in Reinach. The AKP 3-5, being our smallest coldformer, is currently available for training, demonstration and research projects.

The new Hatebur Coldmatic AKP 4-6 S horizontal coldformer in the Arnold corporate colors.

ARNOLD UMFORMTECHNIK – ONWARDS AND UPWARDS WITH THE COLDMATIC AKP 4-6 S

Anita Werten Stephan Dürer

Almost 60 tonnes of various metals are processed every day at the Arnold Umformtechnik production facility in Forchtenberg-Ernsbach (Germany). Most of it is made into high-tech components. The company (a subsidiary of the worldwide Würth Group) is a development partner for intelligent and innovative solution concepts that places great emphasis on comprehensive customer support. It is a dynamic operation that increasingly sees great potential in cold forming. That is why it has recently invested in a Hatebur Coldmatic AKP 4-6 S for the development of new and more complex precision formed parts.

Dirk Döllner, CEO.

Wherever the safety and protection of human life is a prime consideration you will find fastening elements made by Arnold Umformtechnik. The company's biggest customer is the automotive industry. Arnold Umformtechnik supplies all major car manufacturers in Germany and other European countries, and has significant shares of the Asian and US markets. Special screws made by Arnold Umformtechnik play a fundamental part in ensuring that airbags function perfectly when called upon and that child seats, seatbelts and steering columns are properly attached. Those are just a few examples. In statistical terms, around 200 parts of a car are supplied by Arnold Umformtechnik. Additionally, the range of activities includes applications in the electronics industry and a variety of other sectors.

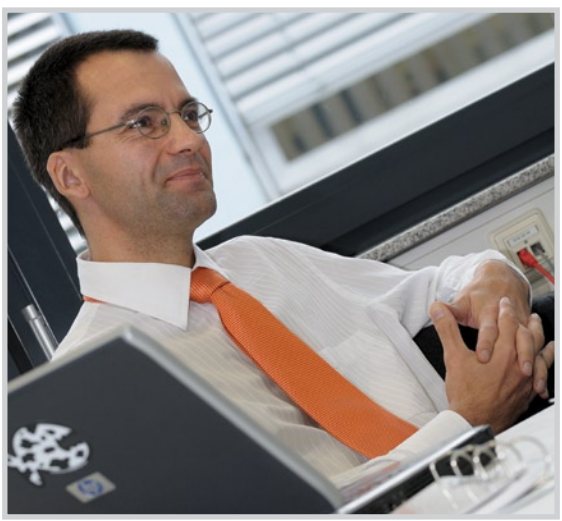
The core business of the company centers around two areas of expertise. Firstly, the brand products, which are made on "simple" double blow headers. Secondly, the area of ultra high-precision functional components, which are produced by the department of multistage coldformers.

"This company's biggest asset is its employees ..."

SUCCESS STORY

Arnold Umformtechnik can look back on a history of over 100 years. Founded in 1898 as a screw-making factory, the business has developed into one of today's leading suppliers of high-tech components through a combination of product engineering and intelligent services. As a subsidiary of the globally successful Würth Group, which employs over 65,000 people in 420 companies worldwide and turns over more than eight billion euro a year, Arnold Umformtechnik and its subsidiaries Arnold & Shinjo and Arnold Technique France recorded sales of roughly 100 million euro in 2007. Of that figure, nearly 85 million euro was generated from the sale of over 3.5 billion fastening elements with dimensions up to 16 millimeters in diameter and 200 millimeters in length. And the trend is rising.

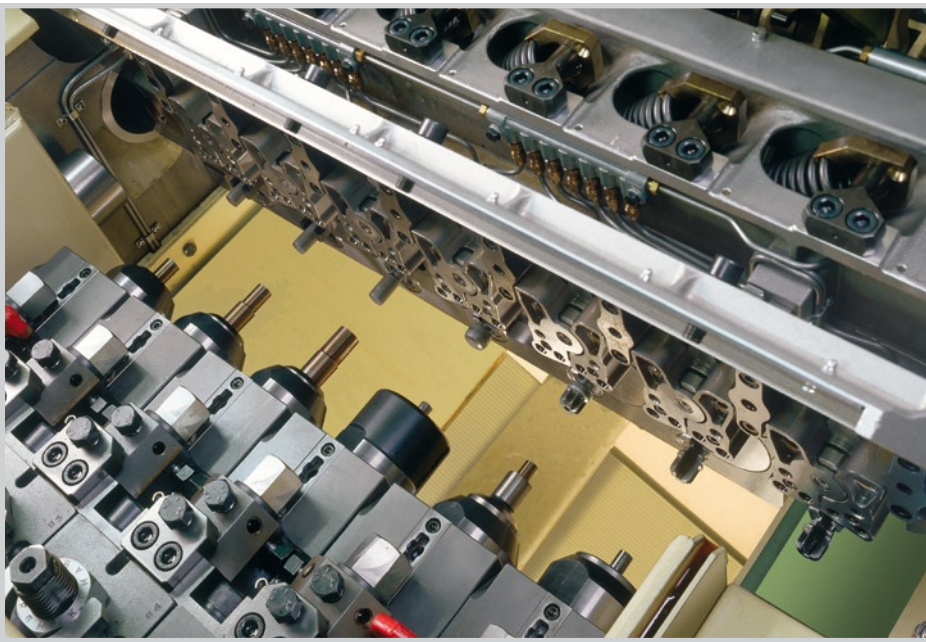
In the opinion of Dirk Döllner, CEO of Arnold Umformtechnik, a significant factor in the success story so far as well as the future development of the company are the 500 members of staff. "This company's biggest asset is its employees. It is decisive for the success of the business that they support the development(s). Anyone can write a mission statement, but the workforce has to actually put it into practice afterwards." That's the reason why long-term employment and team-building play an important role within the organization. Even outside working hours, a full range of sports clubs and informal events promote the interpersonal relationships. In particular, the company's own training center for upcoming development technicians and engineers is an important breeding ground for the implementation of the progressive corporate philosophy.



Uwe Fleckenstein, MST design manager.

POTENTIAL

The positive sales trend can only be achieved by a particular consistency and working method, and clear objectives. For the future, the management is putting its money on continual growth, especially in cold forming. "The potential of cold forming is very large across the whole industry. This technology enables us to manufacture many products much more efficiently and to expand the product range in that area. We can respond better to the needs of the market and are able to offer our clients excellent customized solutions," elucidates Dirk Döllner. The rapid rises in material costs are another reason why cold forming is becoming increasingly lucrative because it uses the raw materials much more economically than metal-cutting processes.



View of the tool room of the AKP 4-6 S.

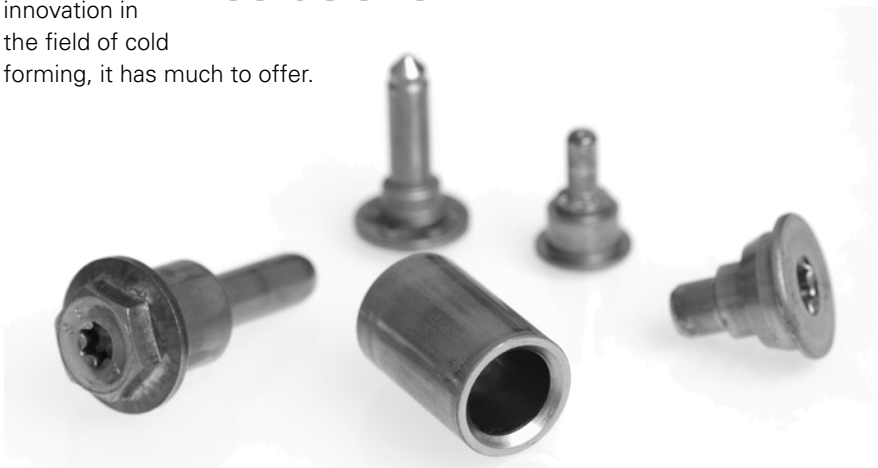
COMPREHENSIVE CUSTOMER SUPPORT

Arnold Umformtechnik recognized a long time ago that, in a constantly competitive environment, you are always replaceable, and that distinguishing yourself from your competitors is the only way to sustain success. Their decisive success factor is their comprehensive customer support – a service-oriented attitude virtually unique in their particular industry, and one which complements innovation and product quality as the other factors in their success. Through strategic development partnerships, the forward-looking company is able to integrate in the development and design processes of the client from an early stage and to work together to create the most economically and technologically viable solutions. "We don't supply standard products, we provide customized solutions. The customer is offered the full range of services in the product development process. That has always been our strength and it is something we are now looking to expand further in cold forming, because a close partnership and all-round cooperation with the customer is essential in order to fully exploit the potential of this market. Arnold Umformtechnik can only distinguish itself from the competition by its expertise and the quality of its work," Dirk Döllner points out.

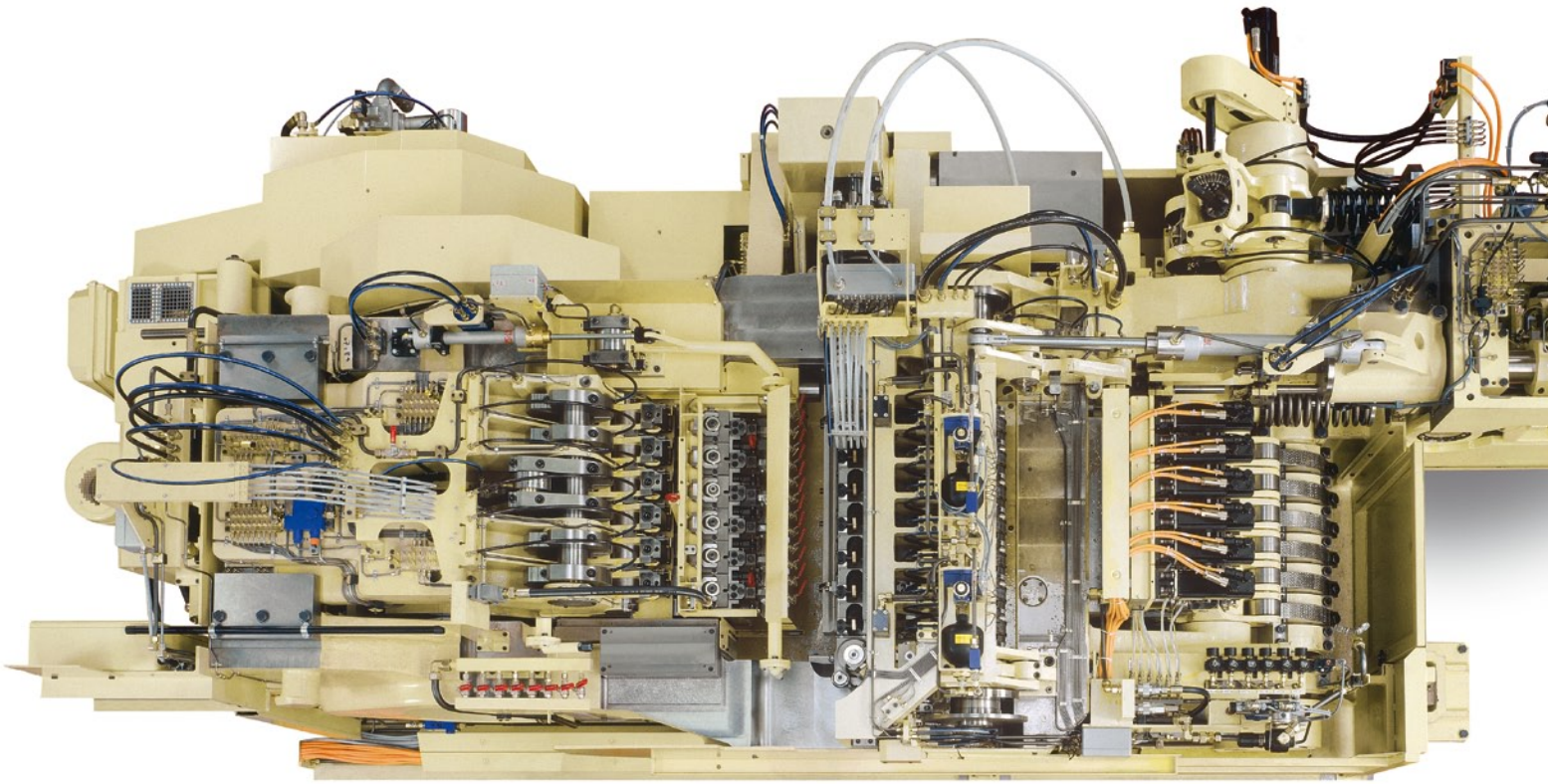
INVESTMENT

To achieve its aims, Arnold Umformtechnik has extended its high-tech production plant by the addition of a Hatebur Coldmatic AKP 4-6 S. As the latest Hatebur innovation in the field of cold forming, it has much to offer.

"We don't supply standard products, we provide customized solutions"



A small selection of the parts that are made on the AKP 4-6 S.



Overhead view of the Coldmatic AKP 4-6 S.

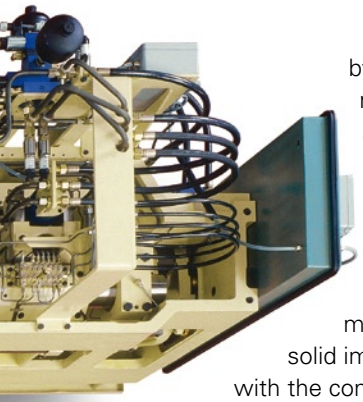
A total press force of 2300 kN, six forming stages, safe lateral transfer with seven grippers, Variblock quick tool change-over for a faster retooling, linear infeed and high-speed shearing system are just a few of its outstanding features. The Hatebur cold-former is the first machine with six forming stages at Arnold Umformtechnik. On that basis alone, it offers an enormous diversity of new development possibilities. For example, it gives the company the capability of expanding the dimensions and complexity of the parts it produces and, therefore, of broadening its product portfolio. That is because the new coldformer means that components and multistage parts with a greater diameter can be produced for the first time. "The potential that this machine opens up for us is enormous," enthuses Dirk Döllner.

"The potential that this machine opens up for us is enormous"

Combining it with new tool technologies creates the capability for a vast range of products. It will be possible to manufacture new and more complex components more efficiently. "The important thing is that we find attractive solutions for our customers by making use of the Hatebur forming technology," Dirk Döllner emphasizes.

WHY HATEBUR?

The investment came about as a result of an extensive and detailed analysis of the market trends and demands. It is the sort of decision that is not taken overnight and was the culmination of a process that started 4 to 5 years ago. The choice of machine manufacturer was the final step. Dirk Döllner and his colleagues Uwe Fleckenstein, MST design manager, and Gerd Pfeiffer, multistage coldformers team manager, are unanimous, "There were a number of reasons why we decided to buy a Hatebur machine. It has a very broad manufacturing capability compared with competing products. We were also immediately convinced



by the handling of the machine. It is logically structured and easy to operate. That means the operator can concentrate fully on the use of the tools. In terms of design, the machine made the most solid impression compared with the competitors. And the short tool change-over times are an important advantage for us, as we don't plan for mass production and therefore need to change the tools frequently." A last decisive point in favor of working with Hatebur for Dirk Döllner was the similarity in the way the two companies think and act: "Like Arnold, Hatebur offers comprehensive support. As well as the machine itself, they provide the all-important – and for Arnold decisive – added value. More than just the product, they supply expert knowledge across the whole spectrum of cold forming. For example, in areas such as tool development and fast and professional service and support. The aim is to develop and actively implement a long-term relationship."

"... so far matched up to expectations in every way"

The Hatebur Coldmatic AKP 4-6 was installed in the spring of 2008. To integrate fully in the corporate design, it is finished in bright "Arnold blue". It is now in productive use two shifts a day. The first results are very positive and have so far matched up to expectations of Arnold Umformtechnik "in every way".

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The wire feeder of the AKP 4-6 S.

MACHINE SERVICING – HATEBUR OFFERS FLEXIBILITY

Anita Werten Stephan Dürer

Hatebur offers customers professional onsite machining service worldwide. But it can also be carried out on the manufacturer's premises if the client prefers. A recent example is the company Räuchle. They had their coldformer press transported to Hatebur-Lumag Services AG in Switzerland for servicing.

Machine dismantling in progress.

Bottom right: lifting out the press ram.

Some of the Hatebur precision forming machines are very big. With lengths up to 11 meters, some models can justifiably be called gigantic. So when it's time for a major overhaul, that fact means that it is generally advisable to have the machine inspected and repaired on site. Hatebur has a large number of expert service engineers available to customers at any time to do the work. However, depending on the repairs required and the amount of work involved, it can sometimes be worthwhile for the customer to have the servicing done on the premises of a Hatebur service partner.

"The greatest advantage for us of sending the machine for servicing at Hatebur-Lumag Services was the time saving"

FLEXIBLE SERVICE

The most recent example of this scenario was the company Räuchle of Dietenheim (Germany) who decided not to have their Hatebur Coldmatic AKP 4-5 serviced on site. Hans-Josef Kowalski, forming and toolshop manager at Räuchle, explains: "The greatest advantage for us of sending the machine for servicing at Hatebur-Lumag Services was the time saving. The specialist personnel is right on the spot. We were able to have the repairs carried out more efficiently and could respond immediately to other problems that needed addressing in the workshop. Spare parts were available more quickly, the engineers were in direct contact with the specialist department and removal and fitting of parts was easier be-

Service engineers make the last adjustments before the machine is moved.

cause of the infrastructure available to the service partner. We would definitely choose to do it this way again."

The flexibility of Hatebur's services is likely to be especially attractive where smaller machines are concerned. "They can be transported easily by truck and the logistics costs are usually not much more than the travel and expenses for the service engineers," points out Hansjörg Gebhard, customer service manager at Hatebur.

AKP 4-5, made in 1989.

The larger machines have to be extensively dismantled in some cases. But that is no hindrance as far as Hatebur is concerned. "We have carried out a complete mechanical overhaul and service on a Hatebur Hotmatic AMP 70 at one of our assembly plants on a number of occasions in the past," Hansjörg Gebhard elucidates.

ALL-ROUND ASSISTANCE

The most suitable place for servicing is best determined on the basis of the work required and a cost-benefit analysis. Hatebur can help customers weigh up the options and advise on individual solutions during visits and annual inspections. The fact is that in 95% of all cases, the machine is serviced on site. However, if the decision is taken to do it the other way and have the machine serviced off site, it is good to know that Hatebur takes care of everything – including transportation.

Top: view of the serviced tool room. Bottom: the AKP 4-5 suspended from the crane ready for transportation.

TOOL DEVELOPMENT – FROM VIRTUAL PROTOTYPE TO QUALITY PRODUCT

Anita Werten Stephan Dürer

When a new Hatebur tool design is delivered to the client, it has successfully completed several strategic development stages. In the process and tool department a particular design will pass through three different phases, starting with the design, then the manufacturing of the tools, and lastly, testing. Even though the above design phases are closely related, Hatebur recognizes theit distinctiveness and has established a separate specialist in each respective area. "Netshape", in a series of articles, has provided in-depth insight into these development practices. In the first of these articles, we report on computer simulation assisting in the initial design phase.

Part 1

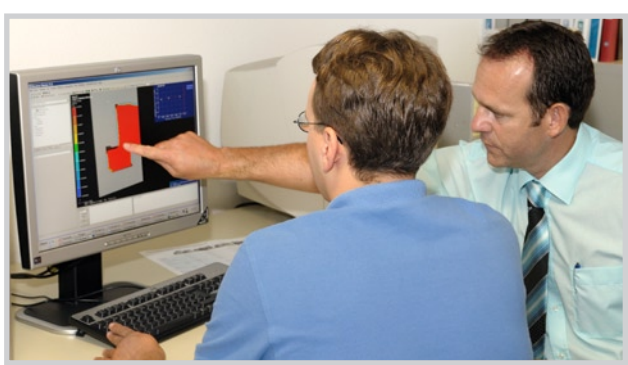
"TOOL DEVELOPMENT"

The development of production-ready tools for fully-automatic horizontal parts formers is one of the most demanding tasks at Hatebur. To be classed as a "good" product it has to meet a number of requirements – an optimum sequence of forming operations with flawless metal flow, adherence to tolerances, process reliability, simple design and low production costs plus long tool life. It is no easy job to bring all of those demands together and it presents the development team with many challenges.
To manage the increasing complexity of products and production processes, Hatebur rigorously employs computer-simulation to aid product development. Advanced methods are used to develop tools that will accurately and economically produce the products required by the client.

LATEST TECHNOLOGY

Ideas that only a few years ago may have sounded futuristic are now present-day reality. The very latest software is used to create 3D models, which, even in the early stages of development, are able to predict the behaviour of tooling and the properties of the component to be made with it. "With the aid of simulations, we can optimize the future product from the early stages of design. Metal-forming faults can be identified and eliminated from the start," explains Patrick Stemmelin, process and tool development manager at Hatebur. "In the past, the sequence of operation was defined to the best of our knowledge and ability before designing, manufacturing and testing the tool. To optimize a product, we had to continually repeat the whole process. With computer-aided simulation, the development times and costs can be substantially reduced and, at the same time, we can supply the customer with a sophisticated product."

The use of virtual prototypes has been a standard routine since 1999. It is the only way to meet the rising demands of customers regarding product quality and complexity.
When you enter the design offices, it very soon becomes clear that computer-aided simulation is now part of the standard equipment of a tool developer. The individual project stages are preceded by what is



Detailed examination of the simulated component.

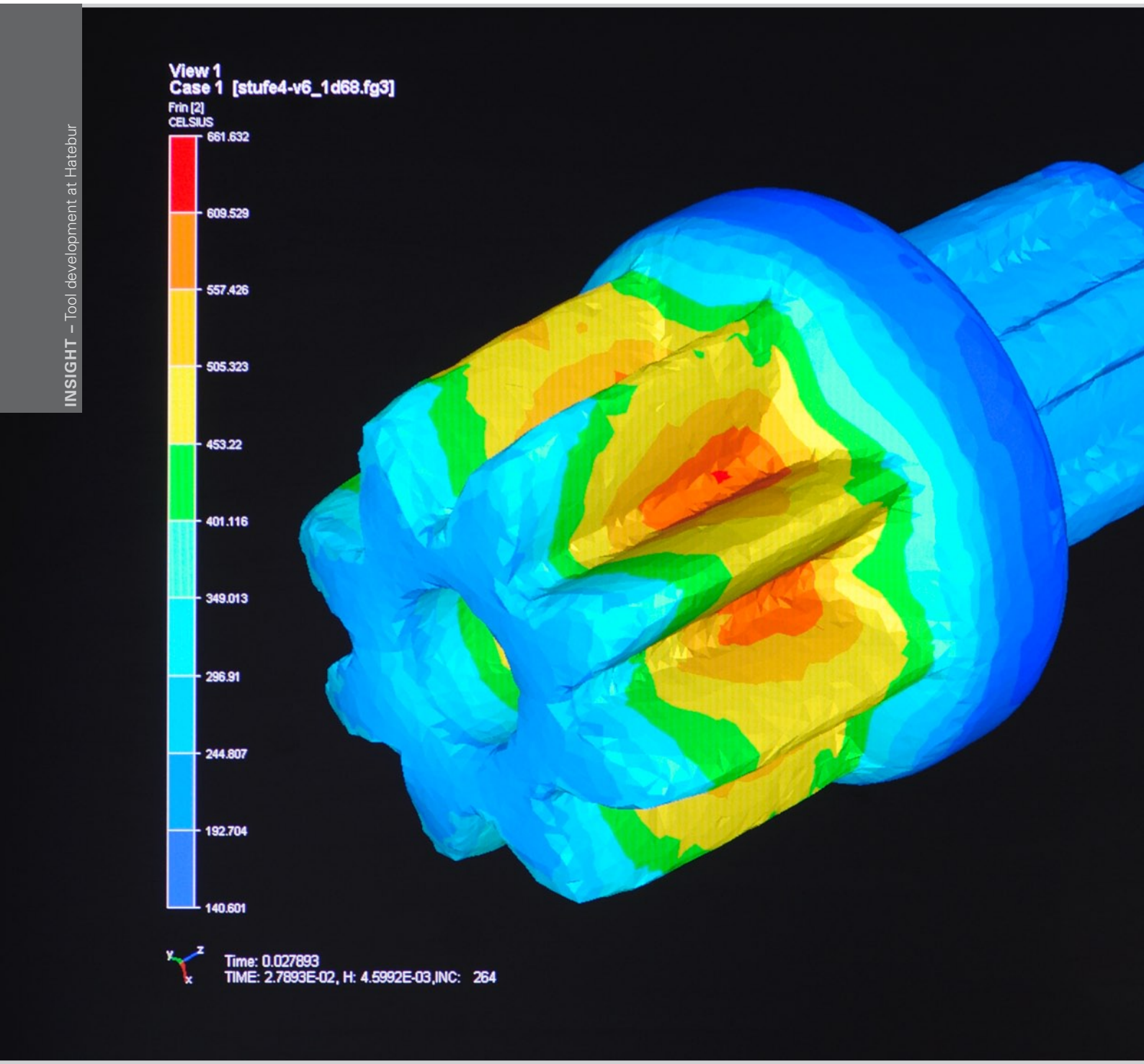
Patrick Stemmelin, process and tool development manager.

called "process simulation" in which virtual tests are carried out to provide a better understanding of the process. FEM (finite elements method), a modern method of calculating complex processes, is used to carry out stress, deformation and force analyses on the products. In addition to those procedures, the designer uses kinematic simulation to test out the transfer of the parts from one station to another. Afterwards, the machine setting parameters are specified. The kinematics programs enable very precise predictions on the dynamic behavior of the parts while being transfered through the machine's tool room.

ULTRAMODERN SOFTWARE

Whether opting for the complete package, production visability study or process optimization, clients can start from any point of the process (see box on page 16) knowing they can depend on reliable computations by high-quality software and the expert knowledge of the Hatebur designers. For process simulation, for instance, Hatebur uses the "Forge 2008" program developed by Transvalor. After entry of the machine-specific parameters and the physical data, this simulator can analyze any manufacturing concept. Simulation of the plastic flow of the material shows whether the required die filling is achieved and what forces are generated in the process. Forming flaws such as folding or narrowing can be identified at an early stage in that way. Calculation of the elastic response of the component after undergoing the forming process enables the design team to assess the dimensional accuracy of the final shape. And by analyzing the hardness within the workpiece, precise conclusions can be drawn as to the eventual properties of the product. An examination of the stresses and stress peaks, as well as an assessment of the temperature progression within the formed component can also be highly revealing.

"With the aid of simulations, we can optimize the future product from the early stages of design"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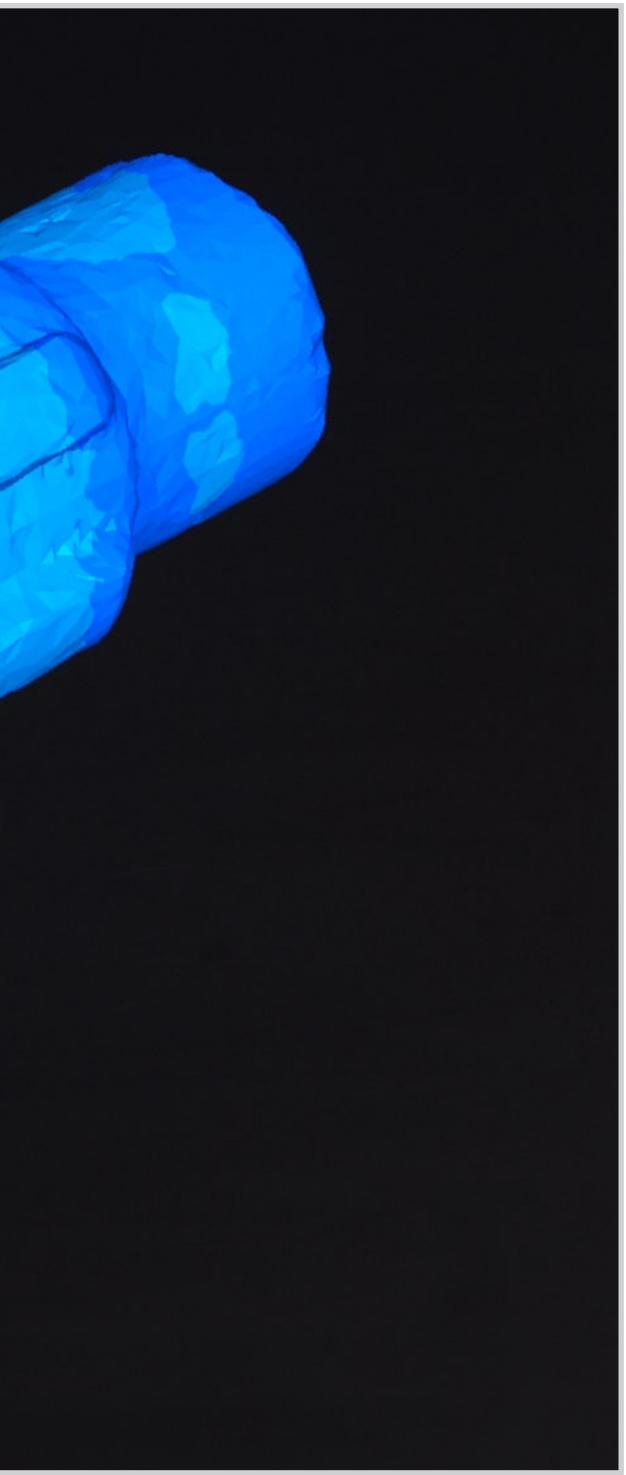

Process simulation using "Forge 2008" shows changes in the formed part during the process.

The complementary kinematic analysis is carried out with the program TTC (Tool Traffic Control). It is based on the Siemens PLM software and was developed jointly with the Shanghai Jiaotong University exclusively for Hatebur. TTC checks for safe and reliable transfer between operations in the tool room. Do the grippers collide with the tool? Is the part held in the most effective way? Those are just two examples of the types of question that can be answered. "By using simulation at this point, we can be confident about the handling of the workpiece through the various stages of the forming process when the tool is first used," states Patrick Stemmelin.

Once the sequence of operation has been defined and the kinematic analysis has been completed, the tool is designed in 3D using a CAD (computer-aided design) system. The Siemens software "Unigraphics NX4" is used for the task.

NECESSARY KNOW-HOW

Despite all the obvious advantages that computer simulation offers in the development process, we should not lose sight of the fact that it is only a tool. Simulation, whether of process or kinematics, is no substitute for established methods or experience gained over many years. The expertise of the engineers and designers remains of prime importance because a sound knowledge of materials, processes, yield limits, possible tool designs and many other aspects can not be entirely replaced by the computer. "The software does not

Sequence of operation on a Coldmatic AKP 4-6 S.

suggest solutions, it only tests them. We still start with a sketch plan of the sequence of operation, which we design on the basis of practical knowledge and experience," explains Patrick Stemmelin. And the expertise of the designers is decisive not only during the simulation preparations but also, and especially, when analyzing the virtual tests. Misinterpretation of the results could have fatal consequences in the production phase. In which case the entire process would have to be started from the beginning again.

"The expertise of the engineers and designers remains of prime importance ...the software does not suggest solutions, it only tests them"

TTC (Tool Traffic Control) simulates the kinematics within the machine's tool room.

There is another aspect of fundamental importance throughout the development process:

TEAMWORK

"Tool development is not a job for an individualist; it can only be done successfully in a team environment. Every new product is always the result of close cooperation between tool designers, tool makers and machine operators," Patrick Stemmelin expounds. The projects are completed collectively within a creative and skill-intensive process. "We simulate, discuss, analyze and, in many cases, simulate again in order to find the optimum solution." In the process, knowledge expands from one project to the next.

CONCLUSION

The "virtual" data obtained from process simulation and kinematics analysis results in a high level of product quality in the subsequent production process and perfect transfer of the workpiece between forming stages on the machine.

"TOOL MANUFACTURE" will be the subject of the second article in this series in the next issue of Netshape (1/2009).

Part 2

SERVICE PACKAGES

As well as the famed Hatebur machine quality, customers have access to a broad range of tool development and production services.
The following options are offered:

❶ **Simulation** (process simulation and/or kinematics analysis)
❷ **Tool design** (including simulation)
❸ **Tool design including manufacturing**
❹ **Tool design, manufacturing and testing** (complete package)

INNOVATION UNDER CONTROL

Christian Bürgin, Anita Werten Stephan Dürer

Hatebur said goodbye to the analog age some years ago with the development of the new machine control platform. The latest precision forming machines are supplied as standard with a programmable logic controller (PLC) and are easy and safe to operate from a touch-screen control panel. Stefan Götz, electical engineering manager, told us about the continuous modernization process in controls technology.

Interviewee: Stefan Götz, electrical engineering manager.

Mr. Götz, how is your team organized – is there a clear separation between those who mainly develop new products, and staff whose jobs involve the day-to-day tasks of dealing with service inquiries and handling machine orders?
"In our team there are seven engineers and technicians involved in ongoing development of controls and dealing with machines. We also have one engineer who works exclusively on continuing development of the Hatebur ESA 600 system, which electronically monitors the bar end dropping and these days is an essential part of the hotformer control. The team is completed by a service technician whose job primarily involves commissioning our large hotformers and the ESA 600 systems around the world. But basically, commissioning and service inquiries are handled by the same staff as are responsible for the ongoing development. In that way, the knowledge gained from maintenance and operation of the systems is put to use in new developments."

ESA 600 control system on the Hotmatic HM 35.

Not all that long ago, forming machines used relay switchgear and DC drive units. Looking at the latest generation of Hatebur machines, it is obvious for everyone that there is plenty of high-tech electronics and IT equipment used. Can you explain the basics of the control system and drive unit technology in simple terms?
"The fundamental component of the control system is the well established programmable logic controller (PLC) that has been around for many years. It works together with a variety of control system components such as the electronic safety relay system, the main drive unit, the AC servo drives and the control panel (HMI). Communication with the machine and the peripheral system components such as conveyors and heating system takes place via a bus link.
We use AC drive units on all our new systems. With high-power drive units, we also use the very latest energy recovery technology."

From what you say, it is clear that a large amount of complex and costly electronics and IT equipment is used. What are the advantages to the customer of this technology?
"Many of the functions available today are only possible because of the new technology. Probably the best example of that is the raw material infeed with AC servomotors. In terms of the main drive unit, AC motors were significantly inferior to the DC drive units in the past, especially at the low speeds required for setting up. You had to accept inaccuracies in positioning. Modern frequency convertors no longer have that problem and, therefore, offer the customer high-precision and low-maintenance drive systems. Another example is computer-controlled machine and tool setting, which enables faster tool change-over at the same time as reducing the risk of operator error. It also simplifies interfacing with peripheral devices and machines, and linking to customers' operating data entry systems."

The machine is operated from a large touchscreen with a graphical user interface. What is the technology behind it and what are the major challenges of producing a graphical user interface?
As far as the hardware is concerned, we use robust technology in the form of an infrared screen and an industrial-use PC. It was clear that this new technology would only be accepted if it was very reliable in operation. Another very important aspect for us was the implementation of an intuitive user interface which could be understood anywhere in the world. We achieved that very successfully by using clearly understandable symbols and a logical structure. Where information needs to be displayed as text, the language selection function means it can be provided in the user's own language."

What proportion for a new control system is created in-house and how much is bought in?
"All the engineering takes place here at Hatebur. With new developments, such

as, most recently, the Hatebur Hotmatic HM 35, controls are planned from the start together with the relevant module designers. The software development is also done in house, as is the input into the risk analyses and, of course, the implementation of the safety measures decided upon as a result. The drive unit axes, on the other hand, are defined by the drive unit manufacturer, albeit according to the Hatebur specifications document. Calculation of the heat losses and dimensioning of the relevant air conditioning, for example, are done by the control cabinet supplier."

How do you make sure that the operators and maintenance teams employed by the machine owners actually know how to use the modern technology?
"We place great emphasis on training the operators and maintenance technicians. If a fault occurs, the controller helps to put the problem right by providing clear error messages with a record of events and by a variety of diagnostic and status indications. If the problem can not be rectified by the operator, we provide telephone support. In some cases, we can connect to the system via modem with the more modern machines. The problem can then be sorted with the assistance of the trained staff on site who know what the mechanical situation is."

What are the developing trends in the control and drive unit markets? Can you venture a prediction?
"Programmable logic controllers are getting faster all the time. That provides the basis for the development of more new features. It will be interesting to see how the use of Ethernet networks continues to establish itself in the industry. Generally, new ways of using bus networks to 'advance' further into the field will continue to appear. We already have sensor/actuator boxes with bus couplers and safety limit switches on a safety bus, for example. Whether and when we take a further step in that direction remains to be seen. The decisive factor for us is, as always, that the new systems already have a high level of dependability. Above all, there must be a genuine benefit to the customer from using them."

High-tech machine controls with touchscreen.

One thing is clear: development of control systems for Hatebur installations continues unabated. Solidly based on decades of expertise, the control platform is continually modernized to reflect present-day demands and new technical possibilities. In this area as in others, there is much to expect from Hatebur.

HATEBUR OPEN HOUSE 2008 –
HOTMATIC HM 35 STEALS THE SHOW

Around 200 delighted delegates from more than 90 companies in 20 different countries – those were the encouraging figures from the official presentation of the first Hotmatic HM 35 during the Hatebur Open House 2008. The event offered existing and prospective customers the ideal opportunity to experience the latest development from Hatebur "live". It took place on the premises of the very first owner of one of the revolutionary new hot-forming presses. Neumayer-Tekfor of Hausach (Germany) opened its doors to visitors from Hatebur for a period of two weeks especially for this occasion. They were given a professional demonstration of how bevel gears are forged on this machine. The invited guests were able to witness for themselves the truly impressive performance of the four-stage hotformer with its unrivaled speed of 180 strokes a minute during the "idle run". The ultra low-impact workpiece outfeed, one of many outstanding features of the HM 35, was also demonstrated. Other highlights of the event included a supplementary virtual presentation on the hotformer and an impressive tour of the factory with its many Hatebur precision forming machines was given. It was a highly successful debut for a unique machine and another milestone for Hatebur.

TRADE FAIRS/EVENTS

Come and visit Hatebur at the following trade fairs:

INTERNATIONAL INDUSTRY FORUM in Kiev, Ukraine: 25-28/11/2008
CHINA FORGE FAIR in Shanghai, China: 07-09/12/2008
IMTEX 2009 in Bangalore, India: 22-28/01/2009

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