Fritz Stepper GmbH & Co. KG, Pforzheim, Germany

What's new in stamping technology

In-line welding, monitoring and assembling plastic components

Two breakthroughs in tool technology by Fritz Stepper, based in Pforzheim, Germany, demonstrate how high-precision stamped parts can be efficiently and economically produced from multiple components. The Pforzheim-based company has traditionally turned to BRUDERER high performance precision stamping presses for this type of work. These two family-owned businesses have worked in partnership for more than five decades.

Michael Stepper, owner and CEO of Fritz Stepper GmbH & Co. KG pointing out the hard-coated edge of a tool element under a microscope. The active components which are subject to wear are given a coating which is three to four times harder than usual, with hardnesses up to 6,000 HV.

Tool assemblies which can be used to stamp, weld and assemble finished parts from multiple components in one process offer a range of production-related and economic benefits. In-line manufacturing provides greater workpiece accuracy and higher manufacturing speeds. In addition to this, transportation and intermediate storage of components are no longer required – as are assembly machines. Furthermore, less machine downtime for set-up processes means greater overall equipment effectiveness.

Michael Stepper, owner and CEO of Fritz Stepper GmbH & Co. KG, explains that all the processing steps are carried out on the BRUDERER machine. This eliminates the need for the less precise but very expensive assembly machines.

Go-to solution provider – anywhere in the world

Founded by his father, Fritz Stepper, the company is at the cutting edge of innovation for stamping tools across the globe. In the mid-1960s, the company developed a modular system which is now the standard in toolmaking: it consists of specific stages for punching, bending, coining and welding which can be swapped out in seconds. In 1981, Stepper was the first tool-making business in Germany to introduce CAD programs and, a few years later, it took the next technological step by adding FEM analysis of all tools.

Stepper has been one of the go-to solution providers across the globe for combination tools for high-precision bulk components for around 25 years, at times, comprising 5,000 individual components. Up to 150 stations execute many different manufacturing steps – from stamping, through welding, to assembly.

Stamping breakthroughs at Stepper

The Pforzheim-based toolmaker Fritz Stepper presents two innovations for tool assemblies for stamping, welding and assembly on BRUDERER high performance stamping presses. Existing camera-based, 100% inspection of finished parts is supplemented by a second, simultaneous inspection using sensor-based weld monitoring which is an integral part of the process. Stepper also uses an automotive plug-in connector made from three pieces to demonstrate that not only all-metal parts, but also combinations with injection moulded components can now be processed in-line.

Stepper has optimised fibre laser technology for use in the tool and can spot and seam weld a range of different materials.

Two new breakthroughs for tool assemblies

The multi-award-winning toolmaker is taking its technology to the next level with two brand new innovations. The first of these was to supplement the existing camera-based, 100 % inspection of finished parts with the introduction of a second, simultaneous inspection using sensor-based weld monitoring which is an integral part of the process. Stepper uses sensors to capture and measure reflections from the weld seams.

The second breakthrough concerns tool assemblies for stamping, welding and assembling: for the first time, in-line processing is now possible not only for all-metal components, but also when injection-moulded components are included.

In-tool weld seam inspection on the tool
Stepper has offered welding directly in the stamping tool for over 35 years. Today, this is carried out using fibre laser sources. They are easy to maintain, require very little cooling, and provide continuously robust performance. Software, controls, process monitoring, and the interface to the B2 and B3 controls on BRUDERER stamping presses are all developed in-house.

Single focal, bi-focal or galvo laser heads are used depending on the geometry of the parts and switching between seam and spot welding is at the touch of a button.

"A BRUDERER stamping press can only achieve its full capacity if it has the appropriate Stepper tool. Both components are amazingly reliable and are the ideal basis for stamping precision volume parts of the highest quality."

Michael Stepper, owner and CEO of Fritz Stepper GmbH & Co. KG

Tool with the fibre welding technology and monitoring using sensors as an integral part of the process developed by Stepper. According to Daniel Ast, Chief Innovation Manager at Stepper, when the tools are used with BRUDERER automatic stamping presses, they are at least as reliable as resistance welding. "This means costs are noticeably lower and achievable stroke speeds significantly higher."

Using sensors takes monitoring to a new level: they inspect the welds in the two to eight milliseconds needed to complete a single welding process. Defective parts are therefore identified earlier and fewer reject parts are produced. The process was developed with scientific support.

"Connecting the fibre laser technology we developed in-house with the new sensor-based, process-integrated monitoring is currently unique," explains Daniel Ast, Chief Innovation Manager at Stepper. According to him, when using these tools on the Swiss machines, fibre welding is at least as reliable as the considerably slower resistance welding on other systems which is also more expensive to maintain. "This means costs are noticeably lower and achievable stroke speeds significantly higher."

The laser modules can be integrated into all three tool types offered by Stepper: PROTO for production-quality prototypes, MODULAR 1 for small to medium batches, and F1 Supertec for large-scale production of up to 10 million pieces.

Non-ferrous metals can be processed on these machines as well as difficult to punch steels with tensile strengths up to 2,000 Mpa. Tool lengths of up to 1,500 millimetres are possible, as well as strip widths up to 100 millimetres, and strip thicknesses from 0.02 to 2.5 millimetres.

Injection moulding in the stamping line: debut plug-in connector for the automotive sector
Stepper has been producing tools for assembling all-metal parts since 1988. Plastic parts can now be included in this process. The stamping experts originally received an order for a tool that could produce a plug-in connector for the automotive sector made of three components, one of which was an injection-moulded part.

Two different metal components are punched from two coils and each is welded at two points. A plastic part is inserted into one of these and the two subassemblies are then "married up" and welded together at five points. Following the sample production run May 2026, volume production will commence in the second half of the year.

Why these innovations are running on BRUDERER stamping presses
Bernd Rexroth, Technical Director at Stepper, sees the company's USP as "tool assemblies for stamping, welding and assembling high-precision volume components – as well as simultaneous processing of multiple strips. The welding technology developed by us, and using our tools in the unique BRUDERER stamping presses allows us to achieve extremely high quality."

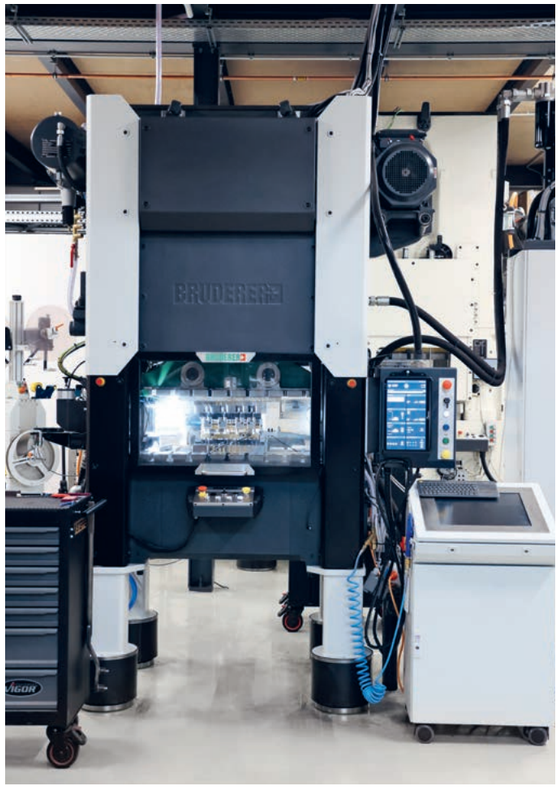
At Blechexpo, Stepper presented integral sensor-based weld monitoring in a BRUDERER BSTA-200/70 stamping press.

There are currently a total of 43 of these systems in use. Michael Stepper's father, Fritz, bought the first BRUDERER stamping presses back in 1965 as he wanted to test his tools himself prior to delivery. Above all, when the BSTA 25 came out, a new product that made headlines at the time with its revolutionary mass balancing that was later patented, there was only one thing that mattered: this technology!

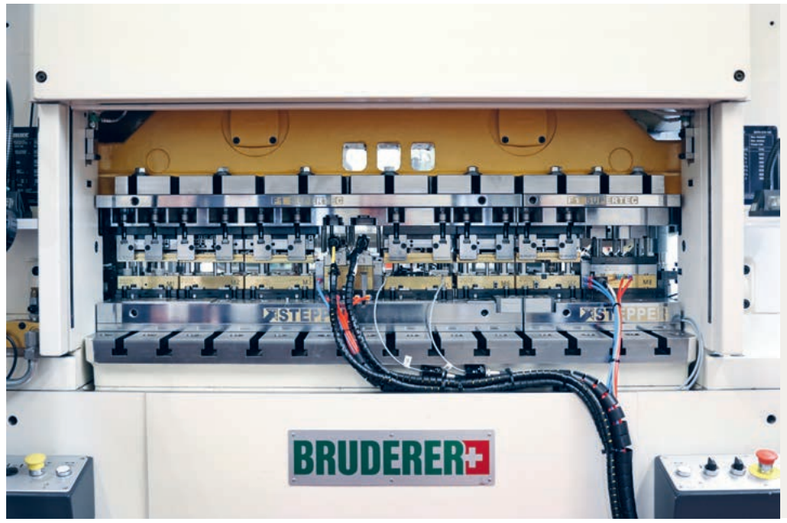
Michael Stepper is still full of praise for these systems to this day: "A BRUDERER stamping press can only achieve its full capacity if it has the appropriate Stepper tool. This successful combination has been produced thousands of times over the past 50 years. Both components are amazingly reliable and are the ideal basis for stamping precision volume parts of the highest quality."

Extensive vertical integration

One of Stepper's key strengths is its highly extensive vertical integration. It is a truly one-stop company – from the raw material, via complete machining with profile and coordinate grinding, to the company's own hard coating using recipes developed by Stepper in-house. The active components which are subject to wear are given a coating that is three to four times harder than usual, with hardnesses up to 6,000 HV. The company's in-house metrology even includes a CT scanner, which is used to inspect 20-millimetre-long connectors at 1,000 measurement points.



Stepper has 43 BRUDERER high performance stamping presses in operation. One of the newest is a BSTL 350-88 with a fixed stroke and a B3 machine control system.



Tool assembly for integral welding and measuring as part of the process, consisting of eight modules. It produces three spot welds in the centre and four around the end and is used on a BRUDERER BSTA 510-125 stamping press with 400 to 500 strokes per minute. Design phase to the first stroke took about five months.

CASE STUDY – Fritz Stepper GmbH & Co. KG

(Left to right) Michael Stepper, owner and CEO of Stepper, Karin Aichem, BRUDERER Marketing and Communications, Ronald Baiker, BRUDERER Area Sales Manager, Bernd Rexroth, Technical Director, Stepper, Daniel Ast, Chief Innovation Manager, Stepper.

According to Michael Stepper, the tool service life has reached record levels: "A tool for tin bronze successfully completed 100 million strokes between two maintenance cycles – with three components per stroke, that's 300 million pieces."

Joint international success

Between five and ten billion components leave the Stepper stamping shop every year contributing around 65% of the company's turnover for its 200 employees. The division has performed well despite the generally challenging market conditions and is seeing an increase in orders. Company director Michael Stepper is exceptionally pleased with new tool production: "This division is also doing extremely well thanks to our innovations!"

Customers come from every sector where precision components are required: from automotive suppliers to communications technology and the watchmaking industry. They have sites all over the world. BRUDERER has also contributed to this by recommending Stepper to its international clients as a tool supplier.

And the opposite is also true according to Michael Stepper: "We always recommend the best technical solution to our customers, and that includes for stamping presses. The final decision is always the customer's and, in most cases, they choose BRUDERER." ■

PROFILE

Fritz Stepper GmbH & Co. KG was founded in 1965 in Pforzheim, Germany, and is now considered to be one of the leading international manufacturers of high-precision stamping tools. The company gained fame through producing the first stamping tool in the world with a modular construction. Today, it is at the cutting edge of technology for tool assemblies for stamping, welding and assembly. In addition to this, several billion parts leave the plant's stamping shop every year, most of which are destined for automotive suppliers, the communications industry or medical devices.

The company has 200 employees and operates under the slogan "Stepper – only the best will do." Stepper has received numerous awards for its innovation and quality, including "Toolmaker of the Year" in the "Excellence in Production" competition on many occasions.

The family-owned business is run by owner and CEO Michael Stepper.

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