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VOGEL COMMUNICATIONS GROUP

Fineblanking

Compared to conventional stamping, fineblanking offers many benefits. It is more and more often preferred, as the smooth cut eliminates the need for reworking.

Jürgen Fürst

Source: ©Poliuszko - stock.adobe.com

Stamping is probably one of the oldest forms of metal processing. With the appropriate presses, thin and thick sheets can be stamped at high speed.

Fineblanking, which was developed in Switzerland in the 1950s, added a slower but very precise stamping process that provides all cut surfaces with a smooth cut, which meets the highest demands. The fineblanking process offers significant advantages over stamping. Precision stamping can also be used to process thick sheets of high quality, similar to fine stamping, but at higher speeds.

Automatic stamping presses achieve high stroke rates with thin sheets

Nobody has questioned the almost unchanged stamping process for more than 100 years. Thanks to the development of presses, higher and more varied steel qualities and the considerably improved tool construction with ever better machine tools, stamping has developed from a rather rough type of sheet metal processing to an ever more precise process. Stamping machines now perform unbelievably well.

Companies such as Trumpf and Bruderer offer high-performance machines for this purpose. With up to 2,000 strokes per minute, stamps punch into dies and punch large series of flat parts out of sheet metal strips or sheets.

As the upper part of the hardened tool, the stamp has the internal shape, while the die has a corresponding opening as the lower part. The sheet metal is located between the stamp and the die. The stamp moves downwards and dips into the die.

Stamping produces scratch-free formed parts in large quantities. The edges of the stamp and die move parallel to each other along the so-called cutting gap and thus separate the sheet metal. This is why stamping is also known as scissor cutting. As a result, scratch-free formed parts are produced in large quantities.

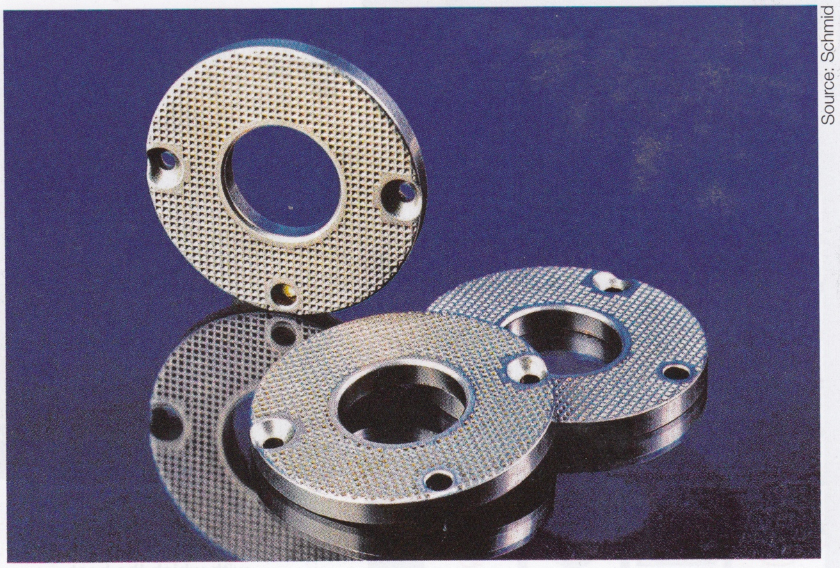
Metal cutting via pressure increase

During the stamping process, the stamp first touches the sheet metal and begins to deform it. By increasing the pressure, the cutting forces at the tool edges increase until the tension inside the material is finally so great that the sheet tears along the cutting contour.

The stamped piece of sheet metal is ejected downwards. When the stamp is retracted, wipers release the sheet or strip from the punch. Depending on requirements, either the stamped slug or the stationary sheet contour corresponds to the desired part.

The high stroke rates mentioned above can of course only be achieved with correspondingly thin sheets of 0.5 mm to a few millimetres and very short strokes. Typically, these parts are used in microelectronics, medical technology or precision mechanics, for example, in the watch industry.

The stamping processes are often supplemented by further processing steps such as embossing, flanging, bending or riveting with progressive composite tools depending on the use of the finished part.



Source: Schmid

In the fineblanking press, various processing steps can be combined using follow-on composite tools.

ETMM INFO

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If the sheets become thicker, not only the number of strokes and pieces are reduced, but presses with greater forces are also necessary. However, with increasing material thickness and higher pressing forces, another problem arises. If the punch exerts pressure on the material to separate it, the material naturally offers braking resistance. At the lower end of the material, this resistance is suddenly broken and the punch rushes through the remaining sheet thickness with great acceleration. With this so-called cutting impact, the material unintentionally tears along more material at the edges and the lower edge virtually frays out. If the finished part is to later have exact, right-angled cut edges, it must be reworked. This post-processing can be dispensed with if the sheet metal parts are finely cut. Fineblanking enables the production of high-precision parts by non-cutting cutting and, if desired, simultaneous forming.

Process of fineblanking

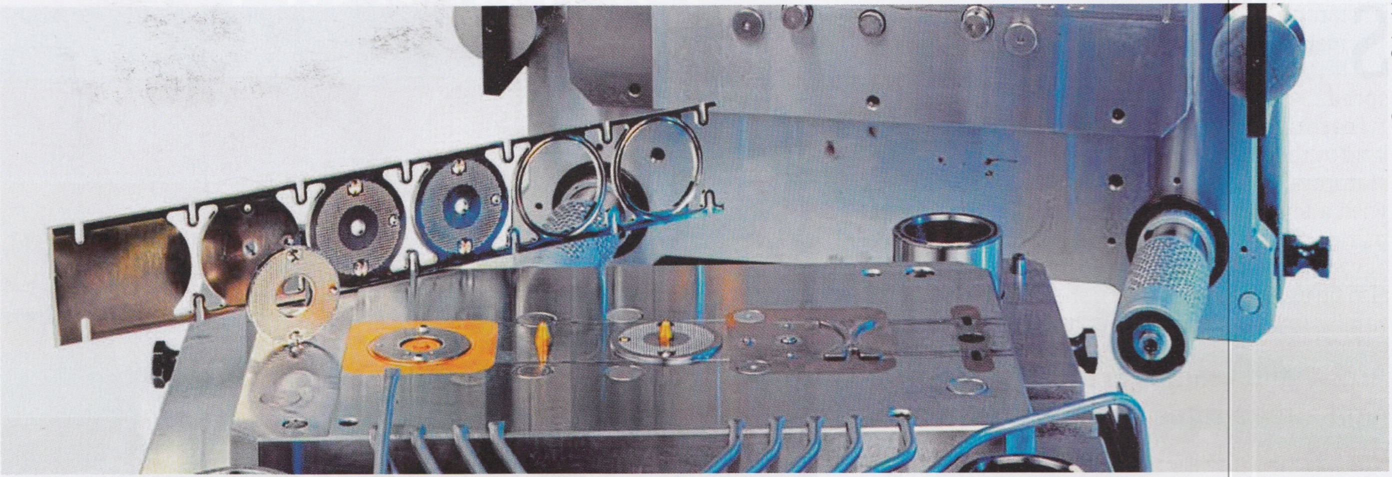
Fineblanking creates finished functional surfaces

As opposed to normal stamping, the punch moves from bottom to top during fineblanking. For this purpose, the raw material is held along the cutting contour by means of a so-called ring jig. Only then does a stamp with the desired shape cut the metal.

In combination with a considerably reduced cutting gap (approx. 0.5 % of the sheet thickness), a cylindrical cutting portion of up to 100 % of the sheet thickness with exactly right-angled cutting edges is achieved, but with thin sheets the cutting gap becomes very small.

Here, complex pillar racks are required for guidance. In the press, further processing steps such as countersinking, stamping, offsetting or penetration can be combined with fineblanking in progressive tools.

The tool set is more complex for fineblanking and, compared to stamping, also consists of a counter stamp and a hold-down device, which press the sheet firmly before and during the cutting process. This in-



Source: Schmid

Fineblanking requires an elaborate and well-conceived tool construction, with which the best results can then be achieved.

duces a state of stress during the shearing process that is as close as possible to the compressive stress range. This increases the forming capacity of the material and the cut surfaces of the component thus do not show any cracks or fracture surfaces.

The workpiece material deforms plastically until the punch has passed completely through the sheet — there is no sudden tearing of the material. These tear-free cut surfaces can be used as functional surfaces without further finishing.

Fineblanking presses today achieve 100 strokes per minute and more

In fineblanking, the workpiece is pushed back into the mould via an ejector before being ejected via the so-called counterholder force and finally blown out or removed. Since 1958, companies such as Feintool AG, founded by Fritz Bösch and now part of the Franke Group, and Heinrich Schmid AG, part of the Feintool Group, have been building fineblanking presses that enable parts with sheet thicknesses between 0.5 mm and approx. 17 mm to be produced economically.

Whereas in the past only around 40 to 50 strokes per minute could be achieved with fineblanking, modern presses today achieve strokes of up to 100 strokes per minute and more.

In particular, linear technology with servo-control, which Schmid brought to series maturity in 2004, led to a significant increase in stroke rates. Above all, however, the servo-drive with the corresponding control system made it possible to finally eliminate the cutting impact.

Controlling speed with servo hydraulic drives

Fineblanking is now also possible at high speed. Thanks to the servo-controlled hydraulic drive, the precisely controlled speed within each individual power stroke can be adapted to each process. A rapid traverse stroke shortens the cycle time, as does a shorter opening stroke when thin parts are to be cut. The flexible speed setting for each step allows, for example, the cutting speed to be accelerated again after slow cutting, even under full load. In order to achieve better material flow during embossing, the ram can be moved briefly at low speed.

Source: Carl Wüst

With the precision punching machine developed by Carl Wüst in 2003, certain areas specified by the customer receive a 100 % smooth cut.

The servo-controlled hydraulic drive, which is based on a hydromechanical position control circuit, enables higher stroke rates thanks to shorter valve switching times and faster movements. The ram movement is hydraulically amplified by an AC servo-motor via a control valve. The servo-motor determines the setpoint. The hydraulic cylinder then executes these specifications exactly. With this technology, the presses achieve the variably adjustable and precisely controlled speed.

World record speed

Schmid produced fineblanked parts at world record speeds of 105 strokes per minute on a 400-tonne press in front of an audience at trade fairs. In customer applications on 160-tonne presses, even 140 strokes per minute and more have now been achieved in running production. The type of part and its later use ultimately determine the process.

Of course, these 140 strokes are not comparable to the 2,000 strokes for stamping described above. In addition, with a sheet thickness of 17 mm to 20 mm, the fineblanking limit has already been reached (tolerances for fineblanking). In addition, either more powerful stamping machines or completely different cutting processes are used.

Several factors are important for fineblanking or stamping

When deciding on stamping or fineblanking, the factors of material type and thickness, number of pieces, application and the required quality of the cut surfaces determine whether the investment should be made in a stamping machine or a much more expensive and slower fineblanking press.

The disadvantages of fineblanking compared to stamping are clearly the considerably higher investment volume and the slower speed of a fineblanking press.

In 2003, Carl Wüst, a company that today belongs to the Wolpert Group, developed a production form between stamping and fineblanking with precision stamping. With it, even thick sheets can be processed with high quality similar to fine blanking. The advantage compared to conventional stamping processes lies in the possibility of specifically mixing precision stamping and conventional stamping in one workpiece.

The special feature of the technique developed by Carl Wüst in 2003 is the combination of conventional stamping, so-called precision cutting and embossing technology in one and the same tool. With this method, subordinate contours, such as the outer contour, can be conventionally punched, while the functional contours simultaneously receive a precision cut comparable to the fine cut in fine stamping.

Precision stamping

Precision stamping combines advantages of stamping and fine blanking. Certain areas specified by the customer are given a 100 % smooth cut.

Other, less important areas, such as the outer contours of a workpiece, are punched conventionally and are therefore more cost-effective than fineblanking.

Through the intelligent design of the stamping tools, the feed, smooth cut and cut-out are specifically designed differently. This way, a quality similar to that of fineblanking can be achieved at the desired points.

If serial parts with large delivery quantities are required, then fineblanking usually lags behind due to the speed. Stamping flanges for the automotive industry, for example, are often produced in large quantities. Annual lots of up to 1,600,000 pieces or 12,000 pieces per day are not uncommon. There, this is not the prime field for fineblanking.

High quantities achievable with precision punches

For example, a stamping flange for an exhaust system with a functional contour on the inside and a subordinate contour on the outside can be produced in the required quantity on a press. The flange is 20 mm thick. The inner contour is a functional contour and is produced as a smooth cut. The outer contour and the holes for the fastening screws are stamped conventionally. The stroke speed does not drop below 80 min-1, even for metal parts of up to 20 mm. For the requirements described, precision stamping has established itself as the third stamping process in over one hundred years of stamping history. *sd*

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Today, modern fineblanking presses achieve stroke rates of 100 per minute and more.

Source: Schmid