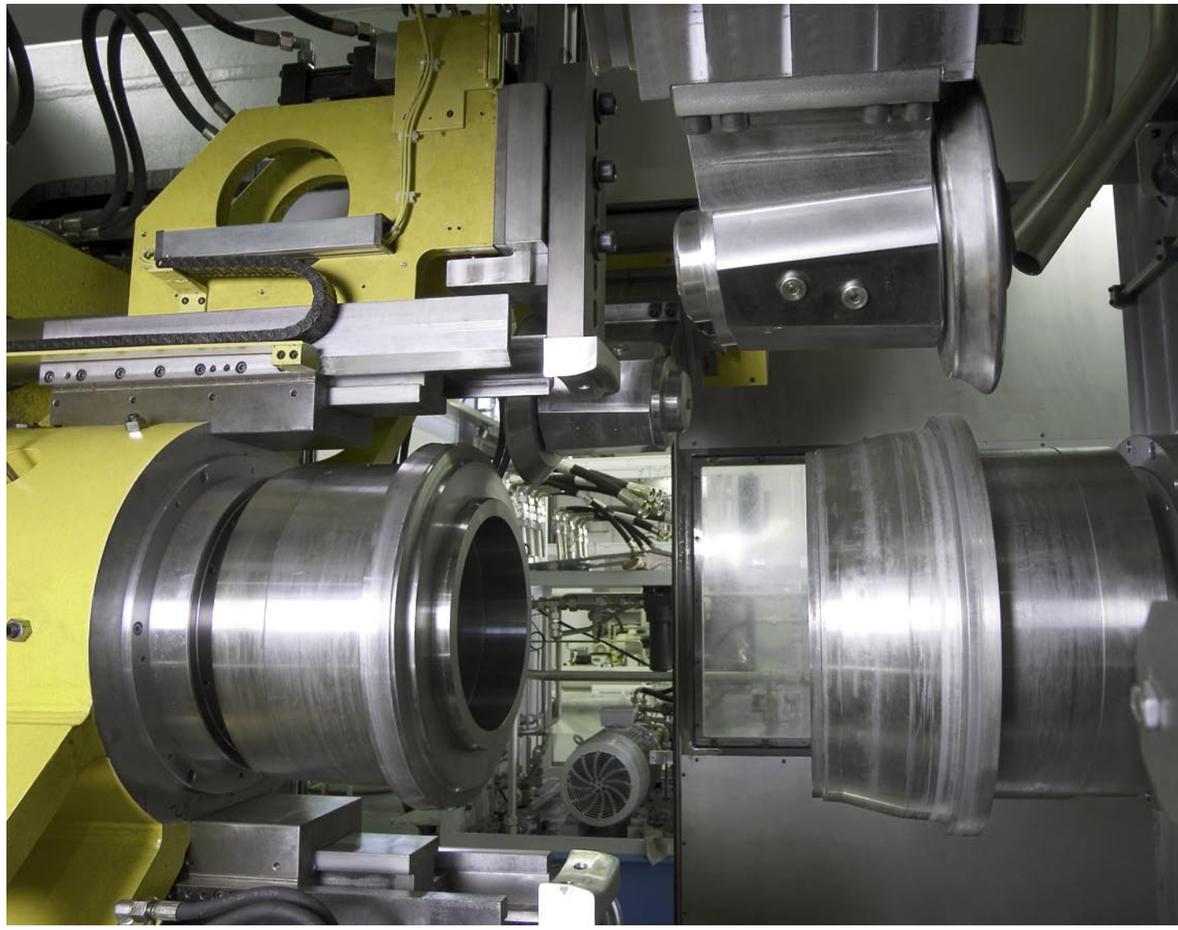
DFplus in metal spinning and flow-forming machines

Application Report
WF Maschinenbau



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Bulletin HY11-3319/UK
2M 01/07

Optimum processing with DF*plus*®

WF Maschinenbau: Take the lead with metal spinning and flowforming machines that provide high precision and repeatability

Positioning accurate to within a micrometre plays an important part in the manufacture of wheel rims, coupling and gear components. Around the clock, year in and year out, extraordinarily tight tolerances must be repeatably maintained. That is why WF Maschinenbau, based in Sendenhorst/Germany, have chosen to utilize Parker Hannifin control valves from the DFplus series in its metal spinning and flowforming machines. The high dynamic performance of these valves yields end products of significantly higher quality.

"Dynamic performance, force and precision - is exactly what we need in our metal spinning and flowforming machines. The technology of the DF*plus* control valves from Parker Hannifin exactly matches our needs", says Heiko Ohlscher, Purchasing and Technical Manager at WF Maschinenbau und Blechform-technik GmbH & Co. KG. Coupling and gearbox components for automatic transmissions, along with wheel rims and wheel hubs for cars and trucks, are amongst the items manufactured on the metal spinning and flowforming machines supplied by WF Maschinenbau.

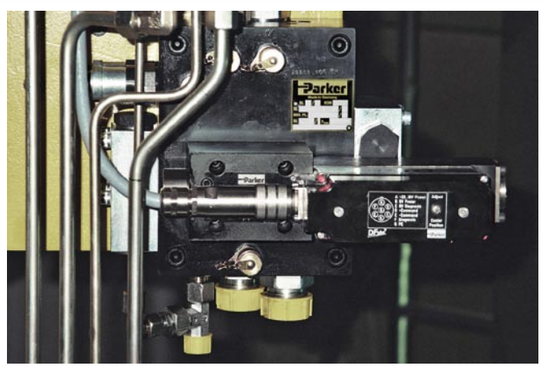
For heavy-duty metal spinning and flowforming processes, WF Maschinenbau offers horizontal implementations, such as the Type HSTA625 machine. In these machines, the rotating working spindles and tools are pushed along the axis of the machine through the fixed support along with the radial feed units.

Ohlscher points out that "Machine productivity and flexibility have a high priority in the minds of wheel rim makers. In addition to this, the metal spinning and flowforming machines must be capable of applying high forming forces in order to generate the required profiles even when large material cross sections are utilized". But it is not just high forces that are needed: highly accurate - and constantly reproducible - positioning is of particular importance. These criteria are equally important for the manufacture of high-precision coupling and gearbox components or for the latest design of "weight-optimised" wheel rims.

VCD®: Proven technology with a new strength

The users of WF machines benefit from the combination of proven forming technology with the newly developed process from WF, in which the DF*plus* valves from Parker Hannifin played the hydraulic, central role. The Westphalian company's enthusiasm for innovation has paid off in the valve technology field. "The application of DF*plus* valves has brought a huge improvement in repeatable precision. The valves react significantly better than other comparable solutions. As a direct consequence we have been able to tighten our manufacturing tolerances by about 40 percent, markedly improving the precision of the components", confirms Ohlscher.

These technical advances are founded on the cleverly devised system of the DF*plus* valves which feature outstanding dynamic performance together with robust construction. The principle of operation is based on the movement of a current-carrying coil in the field of a permanent magnet. The relationship between the force and the coil current in the drive is truly linear, regardless of the particular stroke position, as a result of which the force generated remains the same in all positions. This Voice Coil Drive (VCD) has been integrated into the DF*plus* series of valves, along with other design innovations, as a further development of the moving coil principle.



WF Maschinenbau uses Type D3FP*0 valves from Parker Hannifin. These valves feature short switching times of less than six milliseconds, and a frequency response of 200 Hz.

High reactivity and close control

The Technical Manager sums up the position: "It was the high dynamic performance resulting from the fast step response, as well as the high generated force of about 100 Newton and the kinetic characteristics of the valve that we found compelling." WF Maschinenbau uses Type D3FP*0 valves. At less than six milliseconds, the control valve's switching times are really very short. A small-signal frequency response of 200 Hertz for -3 dB amplitude gain is a further highlight. This ensures precise, stable behaviour when used in higher-order control loops. The piston, accurately guided in a bush, also permits extremely high precision. On-board electronics together with the defined preferred position complete the innovative features of this valve.

The production line that is fitted with DF*plus* control valves makes two-piece, weight-optimised aluminium rims. Welded strips are formed - or spun and flowformed - in several working steps to create a rim profile. The strips are widened in the first step, after which comes metal spinning and flowforming. This involves the thinning of material in specified regions of the rim contour, finally generating the desired rim shape. After the subsequent edge machining and heat treatment, each rim is machine-calibrated for optimum concentricity. WF Maschinenbau has delivered equipment of this sort to famous wheel manufacturers in all parts of the world for many years now.

Metal spinning and flowforming machines used to manufacture wheel rims must generate enormous forming forces in order to shape even when the materials are thick. This process involves the thinning of material in specified regions, generating the desired rim shape.

"The valve could have been created just for our particular application, as we put a particularly high value on exact positioning and repeatability. At the same time, of course, what-ever may be said about component precision, we must not lose sight of the costs. Here again, the DF*plus* matches our ex-pectations", confirms Ohlscher. The series DF*plus* valves have an important place in the metal spinning and flowforming machines: they are used to control the X-axis precisely. It is essential that their reliability and precision are assured, because an axis that is inadequately or incorrectly controlled can soon result in the creation of a large quantity of expensive scrap.

A few micrometres for the toughest demands

Modern wheel rims, which are often weight-optimised, increase the demand for extremely precise axis control. Every millimetre of material must be pushed into the correct position. The DF*plus* valves rise to this challenge with a permanently reproducible tolerance of 3 micrometres, where in the past between 15 and 20 micrometres had to be expected.

The CNC axes on metal spinning and flowforming machines have now become standardised in the same way as the axes on other machine types with hydraulic feeds. In addition to the DF*plus* series of control valves, the reduced-noise, low-vibration axial piston pumps of type PV*plus* are therefore used, as are control blocks, cylinders, filters and connecting equipment. Using these proven Parker components and systems as a foundation, WF Maschinenbau develops and constructs individual machine solutions for its users.

Ohlscher is visibly satisfied about the close co-operation he has enjoyed with Parker Hannifin since 1986: "The support we get from Parker Hannifin starts as soon as our machines are at the planning and design phase, and we also get fast help with questions that arise during assembly or in the course of test runs. Parker's global presence is also valuable when it comes to servicing our machines, as they are located in all parts of the world. On top of this, the technically mature strategy in relation to precision and reproducibility means that we can also satisfy our customers' wishes for a good price/performance ratio combined with little need for servicing."

Heiko Ohlscher (middle), Technical Manager at WF Maschinenbau, in discussion with Parker employees Michael Wolf (ri.) and Willi Schnafel (left).

WF Maschinenbau: innovative and individual

WF Maschinenbau und Blechformtechnik GmbH & Co. KG, based in Sendenhorst, Germany, specialises in chipless forming technology, and is represented in Europe, the USA and Asia. The company, whose headquarters are in Westphalia, develops and fabricates complete manufacturing cells, complete with metal spinning and flowforming machines, for applications in the field of chipless metal forming. They are in use at a large number of famous automobile manufacturers and suppliers.
The company, founded in 1975, holds more than 50 national and international patents for highly developed, modern forming solutions. A high proportion of the machines fabricated by WF consists of machines for the manufacture of pulleys, hubs on coupling and gearbox components, internally toothed coupling housings and gearbox components. Hydraulic feed axes provide the driving force for these components where hydraulic feed axes provide the driving force.