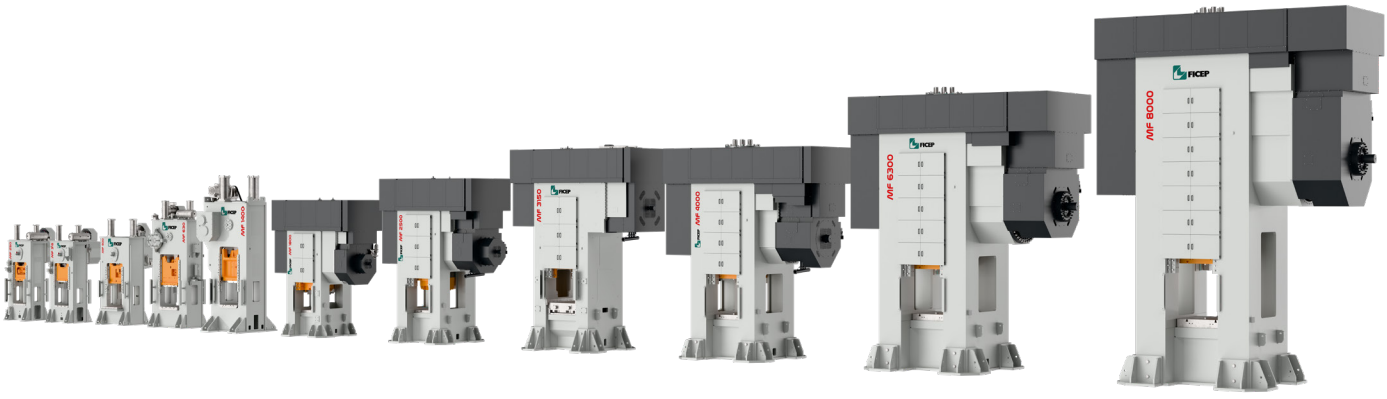
WHAT'S NEXT IN MECHANICAL FORGE PRESS TECHNOLOGY

Peter Campbell and Carlo Maffei



New state-of-the-art technologies are giving a boost to forging with mechanical forge presses. Fully automated forging cells are the standard these days and FICEP's MF 4000 mechanical forge press is the world leader in innovation through efficiency and productivity. The mechanical press, along with FICEP's other equipment offerings, can provide most of the components forging producers need for a complete forging cell. Working with one source makes integration easier and cell operation more efficient. A forging press needs to be flexible for short or long run operations. The MF 4000's drivetrain technology provides flexibility to the forging process. Energy is also a concern, and the MF series has seen another improvement in its energy efficiency that goes right to bottom line in cost savings.

The more complex a forging production line, the more important it is to partner with a press builder who not only knows how to design the individual press but also how to integrate the press into the design of the entire process. As a leader in forging press manufacturing, FICEP provides hot forging producers the unique engineering expertise of a single supplier with technologies involved in all stages of production. With FICEP, every step of the forging production process is within our capacity - from billets cutting, to preforming, forging, and trimming the final forged parts, FICEP produces all key machines you need. With all the needed components FICEP can provide the automation systems that tie the equipment together providing modern forging producers all they need to compete on the world stage of manufacturing. Once installed FICEP's Industry 4.0 technology provide the systems for properly maintaining your forging equipment at the highest level possible.

Established in Gazzada Schianno (VA), Italy 95 years ago, FICEP continually invests in developing its well-established product lines. FICEP provides solutions both horizontally, to cover all stages of the process such as bar feeding tables, sawing, shearing, preforming and trimming, and vertically with a broad variety of size and tonnage ranges. FICEP continually enriches their machine families with new models providing performance and technological advancements.

An example of this is the MF series of mechanical presses. This series features both single and double connecting rod models and cover a force range from 250 tonnes up to 8,000 tonnes. The double connecting rod design balances the thrust force, allowing better use of the large bed table. The latest addition to FICEP's mechanical forging series is the MF4000, which incorporates a technologically state-of-the-art solution capable of combining productivity, reliability, and repeatable high quality. The two largest models, the MF6300 and MF8000, are currently under development.

Four-Part Structure

Designed to handle hot forging of ferrous and non-ferrous materials - particularly steels, aluminium and titanium alloys, the MF4000 press is ideal for producing forged parts for automotive, energy, and gear production. Thanks to the generous dimensions of the 1670 x 1900 mm die-holder plate and the 400 mm ram stroke, the MF4000 can produce a wide variety of components. Equipped with devices that provide rapid retooling, the MF4000 is a productive solution not only for high volume production but also for medium-volume batches with more frequent die changes.

The structure of this machine is divided into four elements; base, crown/head and two columns held together with pre-stressed tie-rods providing a robust structure with a total weight of around 360 tonnes. The MF4000 has a nominal force of 40,000 kN that must be transferred to the piece without deforming the structure. Each element has been engineered to effectively distribute the stresses while maintaining a high level of quality and long-term durability. The fabricated frame components undergo stress-relieving heat treatment that eliminates residual stresses due to the welding process. The well-designed ram guiding system limits the effect of thermal expansion that could compromise machine alignment during use providing repeatable accuracy and precision.

Transmission with Planetary Gear Reducer and Hydraulic Clutch/Brake

Among the most value-added technical solutions installed on FICEP's MF4000 press is the motion transmission system. The traditional pinion shaft drive design with separate pneumatic friction clutch and brake has been replaced by planetary gear reducer combined with dedicated hydraulic clutch-brake unit. The improved drive system is simpler, more compact, and requires less maintenance than the design traditionally used. The smaller number of components, smaller dimensions, and lower mass allow higher rotation speeds to be achieved. Running in an oil bath, the gears run smoother, faster and have longer life than a traditional main gear/pinion design. This engineering innovation translates into more available energy and higher strokes per minute. The hydraulic clutch/brake design is superior to the traditional pneumatic friction clutch and brake design, providing less friction wear, quicker reaction time, greater accuracy.

Maximum Energy Efficiency

Attentive to efficiency, FICEP equips their presses with solutions that not only reduce energy consumption but provide energy recovery. The MF4000 features an optional KERS energy-saving technology that makes full use of the braking phase of the stroke to recover energy rather than use energy. This system provides energy savings of around 10% - 15% sometimes more depending on the application. Its system is composed of a torque motor connected to the eccentric shaft. With this design, instead of a mechanical brake, the ram is stopped at the top of the stroke using the motor as a generator. This energy can either be fed back into the grid or returned to the main motor to make the flywheel regain speed and energy in preparation for the next stroke.

Forging Flexibility – One Press With a Variety of Uses

The torque motor can also be used as a motor starter to accelerate the flywheel. To further support production efficiency and flexibility, the main motor is driven by an inverter that can vary its speed and there by changes the energy stored in the flywheel. This allows for the forging of a variety of different parts and different materials. For instance, the forging of aluminium requires different speeds than some carbon steel parts. The energy required and the rate of deformation varies depending on many factors, including the geometry and thickness, along with the material of the part. The simplicity of changing this parameter is one of the aspects that make the MF4000 a highly versatile press. The MF press can switch from one batch to the next with minimal retooling time. Production flexibility also includes the ability to adjust the shut height with the hydraulic bed wedge and the use of programmable hydraulic or electro-hydraulic cylinders for lower and upper ejector assemblies for precision part location for automation.

Integrated Automation, IoT, Digital Twin and Security

Various types of automation systems can be integrated with the MF4000 press within complex production lines comprised of several machines. Our machine family includes bar handling, sawing & shearing, preforming and trimming presses with robots for material handling and die lubrication. The MF series offers large front and rear openings, plus side openings inside the columns for robot access. Whether it is a single machine with automation or a complete line, to ensure maximum productivity it is essential that the press and robot move in perfect synchrony. Managing an entire forging production through the MF4000's PLC is a considerable advantage. Thanks to FICEP's engineering expertise, the software can manage a single machine with automation or act as supervisor of an entire production line. Moreover, FICEP has developed digital tools that provide the customer with a digital twin to simulate, study, and optimise the work cycle of the press and the entire production line both at the preliminary design stage and for after-sales preventative maintenance and service.

Preventative Maintenance

Production and maintenance needs are constantly monitored through the PLC system using Industry 4.0 designated sensors. The PLC saves the data collected by the sensors and makes it available for analysis in the cloud. Based on the timing required to process each part, the die opening and closing movements are synchronised with robotic loading and unloading, so that all elements operate safely and minimise downtime. Artificial intelligence algorithms identify data variations useful for predictive maintenance and adaptive control of the PLC, through a state-of-the-art IoT. Everything can be managed from a single software system developed by FICEP, which strives to make the human/machine interface extremely user-friendly.

Simplified Management

Even highly automated machines still need skilled operators to check and maintain them, and the forging press is no exception. This is why FICEP engineered the MF4000 with maintenance in mind. The work platform of the crown is assessable from an externally mounted ladder providing easy access to the motor, flywheel, belt, balancing cylinders and lubrication systems. This provides good access for regular Preventative Maintenance. The MF PLC has a simplified maintenance system and a dedicated troubleshooting section for keeping on top of your presses condition. Overall, the FICEP MF4000 offers a robust, flexible and efficient mechanical press design that gives you tomorrow's technology today.

Peter Campbell
Campbell Press Repair
FICEP USA & Canada Sales & Service
Phone: 517-388-1403
Email: pc@campbellpress.com

Carlo Maffei
Commercial Director Forging Division
FICEP S.p.A.
Email: carlo.maffei@FICEP.it