HAMMER VS. SCREW PRESS FOR CLOSED DIE FORGING

By Carlo Maffei and Pete Campbell

Hammers and screw presses have a rich and storied history in forging production. The Romans used a screw press for squeezing olives and grapes to produce oil and wine. Benvenuto Cellini made coins with a screw press in the first half of the 16th century for Italian princes. During the 13th century the use of water as a power source allowed for the use of early hammers. James Hall Nasmyth, a Scottish engineer received a patent for a steam hammer in 1842.[1] But if you think these machines are the dinosaurs of manufacturing, think again. With modern engineering innovations, and cutting-edge technology, both hammers and screw presses forge parts today with optimal quality and efficiency.

Clear Advantages

A distinct advantage of both hammers and screw presses is their variable or non-fixed die opening space. Mechanical forge presses and upsetters, are limited by a fixed die opening or shut height. Mechanical forge presses typically have some adjustment of shut height but usually quite limited. The large shut height on hammers and screw presses provides great flexibility in the size and types of parts you can forge. This also delivers better control over force than the mechanical press.

Hydraulic presses are similar to hammers and screw presses, having variable shut heights and variable force. However, they lack the speed needed to forge lower profile parts and are better suited for deep drawn parts. When compared to hydraulic presses, hammers and screw presses operate at a much quicker pace to forge a variety of parts.

Making the Comparison

It's clear that hammers and screw presses are similar in offering flexibility in producing a variety of parts and offering variable force and speed as compared to other forging machines. Yet, there are important distinctions between the hammer and the screw press that forging producers need to know.

When comparing a direct drive screw press to a pneumatic or hydraulic hammer there are a number of areas where the screw press excels over the traditional hammer:

- High quality of finished parts
- Efficiency in production
- Easier to automate
- Energy savings

The screw press presents North American forging producers with options in production that the traditional hammer lacks.

The Proof is in the Part

The screw press guides the matching of the upper die to the lower die with outstanding precision. This allows the forger to hold tighter tolerances at the match line on the parts and produces a higher quality finished part. A press that can hold tighter tolerances can provide added cost savings because less material is needed to make the forging. Better die match and a more near net shape part also means less time hand grinding or machining.

Higher Finished Quality

Hammer dies tend to have more draft angles allowing the part to pop out of the die after each hit. Since a hammer operator holds onto the part with tongs, he's responsible for manually lining the forging back up in the die for additional blows. The consequence of this technique is forging a part that requires more stock and additional finish work. With screw press forgings, the parts stay in the dies and are lifted out by an ejector. The result? A tighter fitting part to the die and higher finished quality with better dimensional accuracy.

Surface Finish

Another area of quality advantage for the screw press is surface finish. With the screw press, parts stay in the die until being ejected, which allows for increased accuracy, consistency and programmable precision that can't be replicated with the human hand. Scale is removed with air and not pressed into the forging. With the hammer, the part often pops out of the die with every hit, and subsequently the blowing off of scale is not as precise and uniform. There is also a higher chance for scale to go into the lower die and leave an impression on the part.

Efficiency & Fatigue

Typically, a part forged in a screw press requires a single blow instead of the several blows of a hammer, which saves both time and energy. Although some newer hammers offer programmable blow energy, older hammers are completely dependent on the skill of the operator. Even with the most skilled operator there is no exact way to measure the actual energy used in each blow. Consequently, most of the work is absorbed by the hammer frame and component parts. Over time this excess energy absorbed by the machine will show up in wear and tear on machined surfaces as well cracks in anvils, rams, sows, columns and steam chests. The advantage of the programmable screw press is the ability to set it so that only the energy needed for the part is used. This saves on long-term maintenance of the press and lowers your overall operating costs.

Noise and Vibration

The speed of the hammer causes a strong impact that creates more vibration and sound than other forging equipment. The noise and constant vibration that a hammer generates can be tough on an operator and others in the facility. The screw press generates lower noise and less vibration. This also helps with any nearby CNC equipment or vibrations and sound that travels out to nearby neighbors.

Lubrication

Hammer die and guide surface lubrication is typically applied by someone other than the operator, using a mop, brush, or spray. Sometimes sawdust is used for lubricant. Proper lubrication application in terms of amount and location is difficult to manage when done by hand or with a mop or brush. Keeping the applied lubrication clean from slag and particulate is also a challenge. This method of lube application on a hammer is costly, of lower quality and causes accelerated die and hammer wear.

Lubrication for a screw press can be automated with a programmable press lubrication system. As for the dies on a screw press, fixed nozzle lube sprayers or a robot-based system provide exact amounts of lube in the specific areas when lubrication is needed. This saves on overall lube waste and costs and increases die and press life.

Automation

Some hammers have been automated for improved forging production, but this process is more involved and less common due to the excessive costs involved. However, screw presses have the precision needed for automation. With its programmable ejectors, a forged part can be ejected from the die at a specific time, speed and location with the exact force needed. The screw press delivers this level of precision that a robot needs to transfer the forged part.

Tonnage Monitoring

Although tonnage monitoring is critical to a forging operation, hammers are not set up for tonnage or other forms of PM monitoring.

Screw presses are easily wired with the latest PLC controls offering tonnage monitoring as well as temperature, lube, hydraulic and pneumatic system monitoring. What's more, this data can be tracked remotely. With precisely controlled energy and production parameters, using die design software the screw press offers more exacting science than a hammer.

Energy Savings for Manufacturing 5.0

Among screw presses, the FICEP screw press features KERS (Kinetic Energy Recovery System) that stores the energy produced from stopping the ram on its return. This stored energy is then used for the next press stroke. This saves 50% or more of the total energy used in the forging process. These savings translate to lower energy and operating costs and simplified maintenance.

Efficient Design

Not all screw presses are equal, as the FICEP direct drive screw press has more energy available and can reach this energy level as early as three – quarters of the ram stroke. This significantly reduces cycle time, which minimizes heat transfer, and die wear, all while increasing productivity.

We're in an exciting time in manufacturing history, when technology and production are combined to create valuable improvements in how we work and what we make. In today's competitive global forging market, it's vital that North American forging producers identify and invest in optimal forging machines to suit their specific forging production needs.

References

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