Whether a standard forging machine for a variety of forging requirements, or a tube upsetter for upsetting large diameter pipe, or an automated forging machine for high volume production Ajax Manufacturing Co. has the experience and design capability to meet your production specs.

COVER: Rear axle flanges are automatically produced at the rate of 600 per hour on Ajax high speed forging machines. Standard of the automotive industry.
The Advantages of Forging with an Ajax

Ajax, the leader in modern forging machines, has pioneered in the design and manufacture of forging equipment since 1875. Ajax introduced the first general purpose forging machine and continues its leadership by building advanced forging machines that maximize productivity and minimize part cost.

The Ajax line of equipment includes forging machines ranging from 2 to 10 inch capacity and tube upsetters in popular sizes. Forging machines can also be equipped with a variety of transfer mechanisms to produce many parts automatically.

INCREASED PRODUCTION
Ajax machines are designed for reliable service and maximum production. The Ajax-developed direct-acting air clutch offers instant response and smooth, cushioned starting at high operating speeds for maximum production rates. Accurate torque regulation provides overload protection during heading.

The rigidity, power and precise alignment of the Ajax extension-guided header and die slide help produce consistently accurate forgings that require minimum secondary machining, further enhancing productivity. Metal displacement during piercing is very accurate and concentric. Accurate header slide alignment holds tools concentric in the die impression, reducing abrasion and wear when piloting is necessary.

Generous die height on 6 inch and larger sizes provides space for additional forging operations to make more intricate forged parts, and is particularly advantageous on automated machines in these sizes.

Approximately 60% of the headerslide stroke is normally available for gathering stock. This can be increased or decreased for special applications at customer’s discretion.

Production time is maximized because Ajax machine design keeps setup time to a minimum. Slip-tail clamps provide all the holding features of studs without the need for lifting clamps during die changes. Ajax machines can also be “inched” under power to save time and manual effort.

Ajax machines are convenient to operate, further contributing to productivity. Throat opening and operating height provide easy access to the dies so the operator can stand in a balanced position without interference from the tie rod. Forward stock movement is also minimized.

DEPENDABILITY AND SERVICEABILITY
Ajax forging machines operate reliably and accurately for extended periods, even under adverse conditions. Moving parts are protected from scale and water by heavy steel shields which have hinged doors for access to vital areas where inspection and routine maintenance can be made.

For routine maintenance and in the event service is required, all components are readily accessible. The exclusive Ajax underarm construction makes the pitman eccentric bearing easy to inspect and lubricate. The crankshaft can be removed without disturbing the header slide and the cam slide can be removed without disturbing the header slide or crankshaft.

The flywheel, pinion shaft, clutch and brake are located above floor level in the frame extension to the rear of the crankshaft housing. Clutch shaft bearings are capped so the shaft assembly can be removed with minimum machine side clearance.

All machine bearings are conservatively designed and made from carefully selected materials to retain accuracy and assure long life. A pressure lubricating system is standard equipment on 2 through 10 inch machines.

Ajax forging machines are easy to maintain and can be completely disassembled in only a little more space than they occupy. A flat, reinforced concrete slab with adequate area and thickness is all that is required for the foundation.
Basic Components of the Ajax Forging Machine

DIE CLOSING CAM profile produces a large die opening and keeps dies tightly closed during forging.

HIGH MAIN TOGGLE AND ALLOY STEEL PINS provide backing throughout the entire die height.

TOP-SUSPENDED DIE SLIDE is outboard-guided for perfect alignment with the stationary die. A long fully backed shuttle plate supports the moving die under heading load.

MULTIPLE OPERATION DIES can upset or extrude hot or cold stock. Exceptional machine rigidity assures precise die alignment.
POWERFUL DIE GRIP keeps dies closed under load without auxiliary means. A self-contained safety can throw out anywhere in the closing stroke to protect the machine and tooling.

FULL ECCENTRIC CRANKSHAFT is standard on 3, 4 and 5 inch machines. A two-piece full eccentric is optional on 6 inch and larger machines. Standard crankshafts can be removed without disturbing the header slide.

TOP-SUSPENDED HEADER SLIDE is extension-guided to produce accurate forgings under any load conditions.

RIGID STEEL BED is a one-piece steel casting with thick wall and heavy ribbing. Continuous crankshaft bearing housings are integrally cast to minimize crankshaft deflection.

V-BELT MOTOR DRIVE is best for forging equipment because it adapts to a variety of motors and transmits full motor torque.

AIR CLUTCH AND BAND BRAKE offer fast, smooth starting and stopping. Conservative design assures long life and accuracy.

ALLOY STEEL PITMAN has an exclusive nose bearing that takes the forging load and minimizes stress at the wrist pin.

MAIN AND PINION GEARS are alloy steel and have machined teeth. Pinion shaft has anti-friction bearings and the main gear is double-keyed to the crankshaft.
Ajax Construction Features

RIGID STEEL

Bed Frame

Ajax forging machine bed frames are strain relieved, one-piece steel castings. Thick walls and heavy ribbing withstand tremendous gripping and heading forces. The compact frame gets additional support from heavy transverse ribs reinforced with a heavy cross tie clamp. Two clamps are used on larger machines. The clamps provide crosswise rigidity for gripping stock and keeping dies tightly closed for production of flash-free forgings. They do not interfere with machine operation.

Lengthwise rigidity is achieved with a heavy rib that extends over the top of the crankshaft bearing and by a large-diameter longitudinal tie rod. Together they reinforce the die slide, providing excellent die match for consistently accurate forgings.

Continuous crankshaft bearing housings are integrally cast for minimum crankshaft deflection. Large diameter bronze bushed sleeves distribute loads developed during forging and reversal. Continuous bearing surfaces also provide an unbroken lubricating film that reduces wear and assures accurate, long-life service.

Cross tie clamp and large diameter longitudinal tie rod

Continuous Crankshaft bearing housing
Main gear and pinion teeth are machined from alloy steel and heat treated for strength and wear resistance.

Crankshaft and Driving Gear

The large diameter crankshaft is an alloy steel forging, heat treated for proper surface hardness and fatigue resistance. The full eccentric crankshaft (shown) is standard on 3, 4 and 5 inch machines. The main gear is double-keyed to the crankshaft. Forged alloy crankshafts are standard on 2, 2-1/2, 6 inch and larger forging machines.

The exclusive Ajax underarm header slide construction makes it possible to disassemble and assemble the crankshaft without removing the header slide and provides easy access to the pitman bearing for inspection and lubrication.

The flywheel, pinion shaft, clutch and brake are located above floor level on the frame extension to the rear of the crankshaft housing. No floor pits are needed, and minimum floor space is wasted by overhanging parts.
EXTENSION-GUIDED

Header Slide

The main header slide body carries the toolholder, pitman and wrist pin connection and is ruggedly constructed to prevent distortion from heading forces. Extension guide design improves forging accuracy regardless of load and underarm construction makes all major components visible and accessible.

Large bearing surface area keeps the header slide accurately positioned even with the off-center loading of multiple impression dies. Concentric, internally displaced and deep-pierced forgings are easily produced because heading tools precisely match die impressions.

Option toolholders are held securely by a slot type straddle clamp which bears on the toolholder near the ends of the slot.

Extension guide maintains accurate slide position to insure accurate forgings regardless of load.

Wrist pin bushings are undercut at the front surface so that the full heading load is taken by the pitman thrust bearing.

The header slide moves on hardened, ground steel lip liners which extend the full length of header slide travel to provide accurate, reliable operation.
The exclusive Ajax pitman design features a large nose thrust bearing which takes the heading load and minimizes stress on the wrist pin. Bushings for the wrist pin are undercut at the front surface so that the thrust bearing takes the full heading load. Alloy steel bearing cap bolts are used to overcome pull-off forces.

The header slide is extension-guided on all four sides in an unstressed portion of the bed frame where it is unaffected by forging loads. Cast iron extension guide liners assure accurate forging regardless of load conditions and can be trued and shimmed without disturbing the header slide. The slide can be removed without disassembling the crankshaft.
The slide is top-suspended from long, wide alloy bronze faced lips.

Shuttle support plate*

moves with the die slide to provide support against the heading force after the dies close.

* 3" and larger sizes

Standard equipment slot tail die clamps need not be lifted off the studs when changing dies.

Die Slide
WITH SHUTTLE SUPPORT PLATE

The outboard guide extension keeps the moving die in perfect alignment with the stationary die.

Strong underarm member connects the main body of the die slide to the outboard guide with virtually no deflection.

Rear view of the die slide showing the steel faced toggle pin support which prevents deflection.

Front view showing shuttle support plate location in relation to the moving die.

The outboard die slide extension is supported by bearings on four sides.
The die slide is top-suspended and outboard-guided to maintain perfect alignment with the stationary die. Two long, wide lips operate on full-length hardened steel shelf liners to support the slide throughout its stroke. A rugged underarm joins the main slide body and outboard guide bearing and is channeled to discharge forgings and divert scale-laden cooling water from outboard bearing surfaces.

The outboard guide is completely framed with heavy ribbing in an unstressed portion of the machine bed. This die support system prevents sagging and keeps the moving die parallel to the stationary die to produce consistently accurate, well-matched forgings.

**RIGID DIE SUPPORT**
The Ajax-developed shuttle support plate keeps the moving die from rocking under the heading load. Experienced users consider this feature the greatest forging equipment improvement since the air clutch. The long shuttle support plate is attached to the die slide at the extreme left end which allows longitudinal breathing. The shuttle support plate is backed up with bronze liners on the bed for its entire area.

**FAST, EASY DIE CHANGES**
Slot-tail clamps hold the stationary and moving dies securely in place but need not be lifted from the studs when changing dies. Die height on 6 inch and larger machines provides room for more die impressions, and together with the Ajax fast-acting clutch, make it possible to forge in multiple impression dies in one heat.

Die slide alignment is convenient. The heavy steel backing plate on the frame behind the shuttle plate can be removed for truing with the slide in place. The opposite side of the die slide is faced with a bronze liner which can be easily shimmed to restore proper slide fit. Four cast iron outboard guide plates can be shimmed to provide proper running clearance with the slide in place.
Die Grip
WITH AUTOMATIC SAFETY

Cam slide is a rugged steel casting. It is designed to have considerable strength on pull-back.

Springs in the cam slide are mounted on support rods at both ends for safety.

Self-contained safety will throw out from full die opening and reset automatically.

The cam-actuated die grip mechanism is rugged and provides effective gripping without auxiliary mechanisms. The cam profile imparts a smooth die slide motion during opening and closing and an accurate, circular cam dwell keeps dies tightly closed during heading. A return roller spring maintains contact between the accurately machined cast alloy cam and the forged steel rollers. Cam and rollers are case hardened for long life.

In the event of misplaced stock or other obstructions, the self-contained safety mechanism will throw out anywhere in its entire closing stroke, actuating a limit switch that stops the machine. Inching procedure is used to reset the mechanism on the header slide return stroke.

Cam slide is supported in guides both forward and rear of the crankshaft which it spans with a triple bridge. It can be easily removed without disturbing the header slide or crankshaft.

Cast alloy steel cam is machined and hardened. Its profile produces a large die opening and smooth motion during die opening and closing.
The safety mechanism on the cam slide is a spring loaded toggle arrangement which is contained within the cam slide and is designed to trip at a force value determined by the die slide position. Toggle geometry and spring rates are tailored for each size machine to produce the proper throw out characteristics.

Ajax main toggles withstand the tremendous loads developed in closing and holding dies closed. Large diameter alloy steel pins provide backing throughout the entire die height. All pins have liberal end-support surfaces to prevent rotation or working down during service. All bearings are individually and automatically lubricated and protected from scale and water by heavy steel shields.

The die grip on Ajax forging machines is so powerful that it can be used for limited shearing, punching, swaging, slitting and forging operations between the dies.

Hard alloy steel main toggle pin middle supported in the bed frame.
The direct-acting air clutch, first introduced on Ajax forging machines in the early 1930’s, is one of the most important developments in upsetter history. Instantaneous response and smooth, cushioned starting at high speeds makes it possible to perform more forging operations in one heat.

The Ajax air clutch acts as a safety to protect against overload as well. With recommended air pressure, torque capacity is controlled so that the clutch will slip if an overload occurs. An integral ventilation system and low operating pressure keeps clutch temperature low, extending friction material life. Rugged construction includes low inertia steel driven plates faced with non-metallic, wear-resistant friction material. Clutch plates are easily removed.

The conservatively rated hinged-type band brake is spring set and air cylinder released. The brake drum is a score-resistant alloy steel casting. A separate brake for stopping the flywheel is provided.

A short center, multiple V-belt motor drive is used on Ajax forging machines. This drive system is best for forging equipment because it transmits full motor torque and provides a cushion necessary for optimum performance.

Electrical control by a series of relays permits three modes of operation: SINGLE STROKE, CONTINUOUS, and INCH. The three-mode capability increases production versatility and minimizes setup time.

A squirrel cage motor is used on most machines. A punch press type motor with five to eight percent slip is recommended for high speed operation on larger machines. A reversible motor is recommended for inching purposes.

### Specifications

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*Motor R.P.M. 720 or 750
The inherent accuracy and reliability of Ajax forging machines make them ideal for automation. When production volume warrants, Ajax forging machines can be fitted with a variety of transfer mechanisms that make forging production completely automatic.

With the cost of forging labor and materials on the rise, automation is one way to boost productivity and profit. An automated Ajax forging machine is the best way to do it. Ajax automation engineers are ready to custom-design an automation system for your specific application.

Ajax Service is there, too, to back it with installation follow-up.

Ajax forging machines have all the standard equipment needed for most applications, and are designed to accept a variety of instrumentation and control systems.

The need to monitor machine functions increases with production speed, and Ajax forging machines can be supplied with systems to put this information at the operator’s disposal. The Ajax engineering staff can design a system to monitor and display main bearing temperature, flywheel speed, motor current and power, or stresses in the pitman, frame and die closing mechanism. Lube system operation can even be monitored and in the event of a failure, can shut down the machine instantly.

Instrumented machine functions can be displayed on a panel and used to signal the operator of a fault, giving the machine a “self diagnosing” capability.

Automated 10" Forging Machine used in producing van and light truck axle shafts with a capability of producing flanges up to 9" diameter at a rate of approximately 600 per hour. Total weight of machine is approx. 700,000 lbs. This 10" Forging Machine is capable of exerting a 2500 ton heading force.

Ajax forging machines are supplied with steel shields to protect precision internal machine parts from scale and other foreign material. An automatic pressure lubricating system serves all bearings except the clutch, pinion shaft and minor bearings. A hand pressure lubricating gun is supplied for parts requiring periodic lubrication. The pneumatic system includes a pressure regulator and other essential pneumatic system accessories. Ajax forging machines are supplied with a V-belt motor drive. A complete motor/electrical control system is available.

Ajax options include a special built-up crank on 6 inch and larger machines, die and tool-holders, instrumentation and control and automation systems, and the motor and electrical controls. Where certain forgings exert high die loads at right angles to the header slide travel, reinforcing bed clamps can be furnished as an option to provide the necessary rigidity to hold the dies firmly closed during this type of forging operation.
For information on Ajax Tube Upsetting Machines, send for Bulletin No. 93.

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