FORGING PRESSES

For Precision
For Automation
For Top Production

The Ajax Manufacturing Co.
Journal bearings directly adjacent to pitman provide maximum rigidity and minimum eccentric shaft deflection.

Simple, multiple link type brake
Shrink disc clamp provides infinite adjustment for brake drum and bottom knockout cam.

Friction slip flywheel for maximum safety against overloads.

Solid one piece frame of proven design.

Beam type knockout available for multiple knockout applications.

Forged or alloy cast wide steel pitman with special thrust nose design.

Air operated multiple plate friction clutch supported between widely spaced bearings.

Alloy steel ram with long rear extension completely supported and guided through the entire working stroke.

Available with flat die seat or shallow wedge type construction.

The Ajax Line
300 to 8000 Metric Ton Capacity FORGING PRESSES
**FORGING PRESSES**

**Rugged Design for**

**Close Tolerance, Productive FORGING**

**Introduction**

The Ajax Manufacturing Company has designed, engineered and manufactured advanced types of forging equipment for over 100 years, and since the 1930's when forging presses were initially introduced into its range of forging equipment, Ajax has constantly reviewed and improved its original design features to encompass the latest design innovations and high tech options that a modern forging press requires to be as efficient as possible for the large scale production of steel and alloy forgings. Based upon a one piece solid cast steel stress relieved frame, and well engineered drive and control mechanism, the Ajax High Speed Forging Press offers to its user, a powerful, rigid and fast operating machine for the production of accurate warm and near net shape components, as well as conventional hot forgings.

The Ajax Forging Press is offered as a back shafted or direct drive machine. Press designs can be modified to give higher torque, variable stroke speed, and longer forging and ejector strokes according to the work requirements. Ever since the introduction of its first vertical forging press into the forging industry, and subsequently through its design advances of its Twin Pitman Forging Press and Wide Ram Four Point Suspension Press, Ajax’s expertise has allowed its customers a choice of product that best suits their particular application. Adaptation of Programmable Controls and the latest electronic monitoring equipment, used in conjunction with first stage feeders and automatic transfer devices, provides a determination of production capability never before attained. Consequently, through its vast experience in the domestic and foreign forging markets Ajax has successfully maintained its reputation as a reliability leader in the forging industry, which has helped to make the Ajax Forging Press the valuable and economical forging tool it is today. Ajax Forging Presses are built in sizes from 300 to 8000 Metric Tons.

**Closer Tolerance Forgings**

The quality design features of the Ajax Forging Press, particularly its transmission system and the close control guiding of the main ram assembly through its full working stroke, have all been developed for meeting the needs of close tolerance forging. Consequently, all major design areas influencing the press’s use for high quality close tolerance and near net shape forgings have been engineered to be compatible with the needs of the most modern and advanced forging techniques including controlled atmosphere forging.

The Ajax Forging Press with its controlled forging characteristics and accurate stroking consistency allows the user a unique opportunity to plan, develop and minimize his energy requirements when producing an individual component, unlike impacting forms of forging equipment with their unpredictable drive or lift mechanisms, which is evident in the forging hammer or screw press machine.

To ease removal of the workpiece from the relevant die cavity after forging, timed knockouts provided in both the ram and table of the press allow substantial reductions, and in some cases complete elimination of draft allowances in the design of an actual forged component. This design feature offers the potential to eliminate certain post machining operations such as facing, milling and turning, resulting in greater part cost savings.

**Longer Die Life**

A forging die for a conventional hammer or screw press must have enough mass to absorb the impact of the blow. Dies used in hydraulic presses must be large enough to dissipate heat generated by metal flowing during the dwell cycle. Since it is not subjected to impact or high temperature, a forging press die can be produced as an insert, from selected grades of tool steel able to meet the flow characteristics of that particular process. Die life is considerably increased due to the relevant speed of the press and the subsequent short time that the forging is in contact with the actual die during the bottom part of the stroke.

**Operator Skills**

Positive ram travel eliminates the need for the judgement of a skilled operator to decide when a forging is down to size. With an Ajax Forging Press the operator merely trips the press and transfers the heated piece from die station to die station. Automatic ejectors minimize manual effort even in the production of deep impression forging. The controllable time delay of ejector return reduces worker fatigue. The relatively low labor skill requirement and ease of operation result in high production and low direct labor costs.

**Low Maintenance and Downtime**

Since there is no damaging impact as in a hammer, Ajax forging presses are smooth and shockless. This action, combined with a rugged and durable design, result in low maintenance with little downtime.

**Efficient Electric Motor Drive**

The press is operated by a single electric motor through a multiple V-belt drive. Press installation is simpler and less costly than with other types of forging equipment because only electric power is needed at the press. A moderate quantity of compressed air at about 80 psi is required to operate the air clutch, brake release, ram counterbalance and (when used) air ejector.

**Impact Noise and Heavy Foundations are Eliminated**

Ajax High Speed Forging Presses are free of the impact noise inherent in a hammer. The forging load is contained within the press frame, minimizing the ground vibration associated with hammers which can damage other plant equipment and nearby property, or limit operation to restricted hours. The self-contained forging load also eliminates the need for an expensive, impact-absorbing foundation such as is required for a hammer. Foundations for Ajax presses are relatively inexpensive. With good soil conditions total foundation weights are approximately 50% of the total press weight.
The frame is a one-piece, stress relieved steel casting subjected to rigorous inspection at all stages of production using the most modern methods. All wear surfaces are machined and fitted with replaceable bushings and liners. The bottom of the frame is provided with large machined pads to ensure stability on the foundation.

The large openings provided on all four sides of the press facilitate installation of automatic handling devices, die lubrication, and die and bolster changing. Also, a wide view of the work area is available from all four sides of the press.

For a given frame weight, the one-piece frame design has the shortest possible elastic circuit. This provides maximum rigidity between the eccentric shaft bearing and the bottom die seat, and ensures that maximum energy goes into the making of the part to be forged.

The solid steel design has proven its reliability in heavy duty service, and is far more rigid than either multi-piece frames assembled with tie rods or tie rod-reinforced cored frames.

By eliminating the tie rods, Ajax has eliminated the preloading and load distribution problems inherent in tie rod presses. Die life is extended due to reduction of contact time during forging when compared with frames of less rigid design.

Wear Surfaces Fully Protected
All wear surfaces are fitted with generous bushings and liners to distribute loads and to assure long, accurate performance.

Bored holes in the main shaft housing have large diameter cast iron, bronze-bushed sleeves to distribute shaft load over the large frame area, minimizing stress concentration and the possibility of peening.

Ajax has used solid cast steel bed frames in its complete line of forging presses for more than 50 years. The same proven design is used in rolling mills, where rigidity is critical.
**FORGING PRESSES**

<table>
<thead>
<tr>
<th>Heat Treated Forged</th>
<th>Integral</th>
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<tbody>
<tr>
<td><strong>Alloy Steel Eccentric MAIN SHAFT</strong></td>
<td><strong>Flywheel SHAFT BEARINGS</strong></td>
</tr>
</tbody>
</table>

**Eccentric Main Shaft**

The main shaft on all Ajax High Speed Forging Presses is the full eccentric type forged from alloy steel and heat treated after rough machining to meet exacting mechanical property specifications. Large diameter journals supported by sleeve bearings directly adjacent to the eccentric results in maximum rigidity and minimum deflection. This design effectively utilizes the frame crown as a stiffener which minimizes eccentric shaft bending stress. The eccentric shaft can be easily removed from the press, without disturbing the ram, which facilitates bearing replacement.

The main bearings are centrifugally cast leaded bronze and precision machined to fit the eccentric shaft. Each is press fitted into a sleeve which is accurately fitted to the bore in the frame. A gib head wedge inserted between the bottom of the sleeve and the bore provides a very tight fit, assuring maximum support from the rigid crown construction of the frame.

The large bearing surfaces throughout the press contribute to higher utilization as a result of trouble free running, reduced maintenance, and longer life. Improved product quality is realized as a result of maintaining accurate alignment of the moving parts.

![Diagram of Eccentric Main Shaft](image)
The ram is a heavily ribbed, high tensile strength alloy steel casting that is stress relieved prior to machining. The large guiding surfaces on the 4 sides of the main body of the ram are supplemented by an extension guide which rises above the main body creating a high length to width ratio. This design assures accurate ram alignment even during off center loading, encountered with multi-impression dies.

**Ram Liners in Frame**
Ram guidance is provided by wear resistant alloy bronze liners which extend the full length of the slide travel and are readily removable with the ram in place. Full length keys on the removable front gibbs are tongued into the frame and are held captive by large diameter cap screws. This rigid design minimizes lifting of the gibbs when heavy forging operations are performed at the front of the machine; causing the ram to exert substantial forces against the low ends of the gibbs. The ram can be removed from the press without disturbing the eccentric shaft.

**Air Cylinder Counterbalance**
One or more air cylinders are used to counterbalance the ram, pitman, top bolster and die(s). The cylinder(s) are connected to the ram and hold the ram and pitman bearing surfaces in contact throughout the press stroke. This eliminates impacting between the ram and pitman bearing surfaces.
The pitman is made of special analysis steel and the pitman cap is secured by four alloy steel bolts. The large end of the pitman is fitted with a leaded bronze bushing which is made in halves and is keyed to prevent rotation. The press loading is taken on the machined nose of the pitman by a phosphur bronze thrust bearing in the ram which is constantly immersed in the lubricant contained within the ram. The thrust bearing is accurately fitted to the ram and hand scraped to match the mating surface of the pitman nose. This distributes the compressive load over the entire nose section of the pitman, keeping wear to a minimum. This arrangement is superior in design to that of transmitting the load through the pitman pin. The small diameter pitman pin (not under load while forging) serves only to transmit the force required to return the ram.

The pitman pin is supported by bronze bushings which are undercut on the bottom half to assure that the forging load is transmitted by the pitman nose.

With pitman drive, Force Vector C shifts ram against rear ram guide liners for its entire working stroke. The Pitman Compressive Force B is always directed toward the center of ram (front to back) virtually eliminating any tendency for ram to tilt.
The patented Ajax clutch is of the direct, pneumatically operated, multi-disc type. It is mounted directly onto the eccentric shaft whether gear driven or direct drive type, and all parts that are accelerated during engagement have low inertia. The heavier parts rotate with the main gear to assist in storing energy. The inner and outer clutch flanges, main gear and/or flywheel are supported on widely separated anti-friction bearings which straddle the operating plates and do not overhang the eccentric shaft. The large clutch surface area keeps the wear of special friction linings to a minimum. The clutch is air actuated through an annular piston carried in the outer clutch housing. This allows smooth cushion starts even at high operating speeds. As the air pressure is released powerful springs act directly onto the outer driving plate to disengage the clutch.

The design of the Ajax air clutch simplifies inspection and adjustment and under normal working conditions gives many years of trouble free operation.

The movement of the direct acting annular piston can be measured and adjusted for specific travel without disassembly. Pressure lubricated bearings are sealed to prevent lubrication from entering the clutch plate area.

The Pinion and Main Gear
The main pinion and main gear are made of heat treated alloy steel and have precision machined teeth. The pinion shaft is supported on anti-friction bearings whose housings are an integral part of the press frame. The special design of spur tooth results in reduced gear noise and at the same time maintains a tooth form of ample strength that provides maximum life.
Ajax offers two designs of brake for its full range of forging presses. The heavy duty link type band brake is mounted on the end of the eccentric shaft opposite the clutch. It is set by powerful springs and is released by a direct acting air cylinder. The brake sections have high grade friction linings and are linked to prevent breakage and to provide a long service life.

Ajax can also supply a multi-plate disc brake as an alternative to the heavy duty link type brake previously offered.

The multi-plate disc brake is a totally enclosed unit and cooled through a forced air system. The brake is set by powerful springs and released by means of an air operated piston within the brake configuration. The control system provides for differential timing between the brake and clutch, preventing them from being engaged simultaneously. This brake is shielded from the contamination of the forge shop environment and is therefore easier to control its working efficiency in polluted atmospheres or varying types of environment.

The driving power from the motor is transmitted to the flywheel through multiple V belts. The motor is mounted on an adjustable bracket which allows for setting the correct tension of the V belts. The fulcrum of the motor bracket is an integral part of the frame.

The flywheel is an integral part of the clutch in the direct drive press.

With a back shaft drive more energy is available and a greater variety of work can be forged. The flywheel is designed with its own friction slip which protects the drive components between the main gear and the flywheel. Nominal torque setting for flywheel friction slip is 10% more than effective clutch torque. Once properly set it is virtually maintenance free.

A pneumatically operated flywheel brake stops the flywheel promptly after the motor has been turned off. Consequently die changes or adjustments can be made immediately without hazard, but you must follow shut down procedures completely before performing the above services.

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**FORGING PRESSES**

<table>
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<tr>
<th>Link Type Band or Multi-Plate Disc</th>
<th>Safety Friction Slip Hub</th>
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<tr>
<td>BRAKE</td>
<td>FLYWHEEL</td>
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A shallow angled adjustable wedge of massive proportions is provided to distribute the forging load over the entire bed surface. To speed up die height adjustment using the shallow angled wedge, the movement of the wedge can be powered and the vertical motion monitored by a digital readout on the operator panel.

As an alternative a flat die seat can be provided in the bed of the frame to assure maximum die stability, which further reduces die mismatch. This design feature is commonly used in conjunction with automatic transfer systems.

Hydraulic Bottom Wedge Adjustment and Bolster Clamping
The hydraulic wedge adjustment package for flat die seat presses has stall relief capability. While using more of the shut height than the die seat plate that it replaces, the hydraulic cylinder driven wedge provides positive adjustment. The cylinder has a zero leakage piston and special valving to lock in the wedge position. The bottom bolster is bolted to the bolster plate that is held down hydraulically by 4 integral cylinders. This allows quick, simple pushbutton operation for the adjustment. The adjustment position is indicated by a digital display. Positive seals on both sides of the moving wedge forms a large area that can be pressurized to free the wedge allowing it to be retracted in the event of a stall.

Air Actuated Bottom Wedge Adjustment
The air actuated bottom wedge utilizes a pneumatic impact wrench to provide the torque necessary to move the bottom wedge. The wrench drives a screw backed by a large thrust washer. Two pneumatic cylinders act to assist the impact wrench in adjusting the wedge position, and then take up the back lash in the wedge-screw drive after the adjustment is complete.

Hydraulic bottom bolster unclamping eliminates the hold down bolts for the bottom bolster. Hydraulic cylinders acting on the front and rear of the bottom bolster hold it securely in place. The front cylinders are located below the die seat to allow the operator the maximum working area.

The combination of the air actuated bottom wedge and hydraulic bottom bolster clamping provides quick, automatic pushbutton adjustment of the shut height. The shut height adjustment position is indicated by a digital display.
### Automatic Ejection

#### Top and Bottom

**Powerful Top and Bottom Ejectors Standard**

Single or multiple knockouts in the ram are actuated by the pitman. The bottom knockout is actuated by a cam on the main eccentric shaft through a vertical lift rod and levers running from left to right under the die seat. The bottom knockout may also be operated by a pneumatic cylinder, providing the delayed knockout required for some forgings.

**Knockouts**

Automatic knockouts are provided in the ram and die seat. Timed for rapid ejection, they aid the operator in achieving a high production rate, and they reduce the contact time of the forging on the dies, prolonging die life.

The powerful, central mechanical top knockout is actuated by the pitman. Contained within the ram, the top knockout is arranged to begin its knockout stroke immediately as the ram starts up on the return stroke. Multiple top ejectors can be furnished. Stroke length is adjustable, and overload protection is provided by a breaker bolt in tension in the vertical lift rod.

The beam type bottom knockout has a parallel lift motion which produces exactly the same movement in every ejector pin, an ideal action for automatic forging applications. Any reasonable number of ejector pins can be provided in the frame along the left to right press centerline.

The design of the knockout linkage allows the lift rod to be located off the press centerline, allowing full access to the opening in the side of the frame.

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### Additional Standard

**Accessories**

**Lubrication**

Central automatic pressure lubricating system for all principal bearings. Alemit fittings and hand gun for anti-friction and small bearings.

**Pneumatics**

Air shut-off and bleed valve, air pressure regulator, clutch reservoir impounding tank, air line lubricator and filter, pressure gauge.

**Load Monitor**

A mechanical strain gauge is mounted on the front right hand column. It has a dial indicator that is graduated in percent of rated full load. The dial indicator registers and holds the maximum load for a given forging operation. As an option to this standard accessory an electronic steam gauge load monitor can be mounted to the front column of the press. It has a digital readout which can be calibrated to two decimal places and can show either percentage load of the maximum capacity of the relevant press or actual load, whichever is desired.

**Guarding**

Steel shields for the gear and pinion, the V-belt drive and the front of the ram provide protection for shop personnel while permitting accessibility for inspection through conveniently located access panels.

**Die Safety Block**

The safety block is inserted between the top and bottom bolsters to prevent accidental ram movement whenever dies are being adjusted or repaired.

- Auxiliary air brake stops flywheel when power is turned off.
- Safety friction overload protection in flywheel.
- Pneumatic counterbalance cylinder(s) for ram with separate surge tank and pressure regulator.
- Adjustable hinged motor bracket, multiple "V" belt drive, motor sheave, flywheel guard.
- Necessary wrenches.
Press Drive Motor
The motor for the press drive is a totally enclosed fan cooled, continuously rated, high slip (5-8%), squirrel cage induction motor. It is provided with anti-friction bearings, a winding thermal protector, and high breakdown torque.

Press Controls
The electrical controls including the starter for the press drive motor, sequence and control the lubrication system and the three modes of machine operation (SINGLE CYCLE, CONTINUOUS CYCLE, and INCH) through a series of relays.

With the control set for SINGLE CYCLE, the footswitch actuates control relays which sequentially release the spring set brake and then engage the spring released clutch. The end of cycle is controlled by a rotary cam limit switch, chain driven from the eccentric shaft, that sequentially disengages the clutch and then engages the brake to end the cycle with the ram at top dead center position. Circuitry requires that the operator release the footswitch prior to starting another cycle. Depending upon requirements, the footswitch can be replaced by a pair of RUN pushbuttons, widely spaced for two hand operation.

With the control set for CONTINUOUS CYCLE, the foot-switch starts the press cycle as before, however, the rotary cam limit switch is bypassed, allowing the press to cycle continuously until the footswitch is released. Then the rotary cam limit switch acts to end the last cycle.

With the control set for INCH, the motor is used to bring the flywheel to a speed suitable for inching. Two INCH pushbuttons actuate the controls relays for the brake and clutch causing the press to cycle slowly until the INCH pushbuttons are released. Inchig is accomplished from the stored energy of the flywheel — the motor is not powered during the INCH cycle.

Die Lubrication System
The die lubrication system operates automatically, with multiple spray jets for the lubricant and air jets for scale blow-off. The jets for the top and bottom dies can be actuated by a footswitch, or automatically after a preset number of press strokes.

Bolsters
The top and bottom bolsters are made of alloy steel castings or machined from die blocks. They are fitted with hardened steel liners under the dies. The widely spaced large diameter guide pins have hardened steel bushings and are generally located to the rear of the bolster. The bolsters may be arranged for either round or rectangular dies and include necessary die clamps and holding screws. Multiple ejectors can also be provided.

Burnout Bar Assembly
Installed between the ram and the top bolster, burnout bars take up a small amount of the shut height. They provide an economical means of releasing a stall. A bar or bars are torch cut to relieve the load in the press as opposed to cutting the dies.
# FORGING PRESSES
## 300 to 8000
### Metric tons

## SPECIFICATIONS

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<td>98&quot;</td>
<td>110&quot;</td>
<td>134&quot;</td>
<td>147.64&quot;</td>
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<td>112&quot;</td>
<td>128.54&quot;</td>
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<td>109 000</td>
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<td>218 000</td>
<td>308 000</td>
<td>330 000</td>
<td>423 000</td>
<td>585 000</td>
<td>712 000</td>
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<tr>
<td>Weight</td>
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AJAX Reserves The Right To Alter Specifications
## FORGING PRESSES

### 300 to 8000

### Metric tons

### SPECIFICATIONS

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<th>700</th>
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</table>

AJAX Reserves The Right To Alter Specifications
Self-Powered

Automatic Transfer

FORGING

A self-powered transfer system can be provided on Ajax forging presses to automatically advance the forgings between operations. Ruggedly constructed, its innovative design minimizes the number of moving parts. It provides six basic cam-operated motions. All operating cams are mounted on a single shaft, eliminating bevel gears and associated backlash. The entire working mechanism can be easily removed. Safety features include a monitoring system which stops the press automatically upon any malfunction.

Digital Monitoring Systems

Bearing temperature monitoring of the five critical bearings (the two pinion shaft bearings, the two eccentric shaft journal bearings and the pitman thrust bushing) is by means of iron-constantan thermocouples utilizing meter readouts. When an overtemperature condition is sensed, an alarm sounds, and further cycling of the press is inhibited.

Electronic load monitoring utilizes bolt-on strain gauge transducers with a digital readout device to continuously monitor the forging loads. When the load exceeds a preset value a warning signal is given (warning light and/or horn). The overload signal can also lock-out additional cycles of the press.

Flywheel speed monitoring utilizes an electronic tachometer, a magnetic pickup transducer, and an indicating meter to show the flywheel RPM. The slowdown of flywheel speed during a forging cycle is directly related to energy consumption, and excessive slowdown is detrimental to the press drive motor. The tachometer can also be used to prevent starting a
cycle of the press unless the flywheel speed is above a preset level. The press drive motor ammeter displays the motor current on a continuous basis. This is indicative of the work required for a forging blow. Also, the motor idle current is related to the condition of the press drive. The ammeter can be arranged for checking each leg of the three phase power. The above monitoring system can be furnished with strip chart recorder(s) which give a permanent record of the various conditions.

Diagnostic Monitoring Systems
Ajax forging presses are available with electronic systems capable of monitoring virtually any press function. Ajax engineers will design a system to your specific needs that can maximize up-time by indicating fault locations or malfunctions without the need to physically inspect the machine. Systems are available to provide visual as well as recorded capability. Typical monitoring includes flywheel speed, bearing temperatures, tonnage or number of cycles at a specific tonnage, parts counting, motor speed and current draw as well as other operating parameters. This is technology of the future, here today on Ajax presses, to help you produce forgings economically.

Special Quick Release Bolsters
Bolsters incorporating a hydraulically unclamped sub-bolster pack for quick die change is offered as an alternative to standard Ajax bolsters. Engineered to offer maximum efficiency and flexibility for maintenance crews during die changes the bolsters provide the quickest die changeover time with a minimum amount of physical effort. The sub-bolsters can be inter-engineered with proprietary sub-bolster removal packages and incorporates die clamping for circular and rectangular multi station dies. The bolster assembly is engineered to work with complete walking beam automation or first stage feeders and can be designed to meet an individual customer's specific needs.

First Station Feeder and/or Billet Transition Chute
A variety of first stage billet feeders, either hydraulically or pneumatically operated can be provided to move the heated stock through the side window of the forging press in the correct orientation. Flexibility within the feeder mechanism allows the heated stock to be placed at the first die station either up-ended or laid flat. The interconnecting transition chute feeding the heated stock to the feeder fingers monitors over/under temperature and double billet. A reject gate is provided to eliminate billets which are not within temperature specification and evens out irregular supply of billets. Mounted in the side window of the forging press, the unit is fully safety interlocked with the press control system. Consequently, it provides a reliable and flexible forging aid to ease operator fatigue and increase productivity.
2500 metric ton Ajax Forging Press/ back view with protective shields removed.

Other Equipment from Manufacturing Company

Forging Machines
Tube Upsetters
Forging Rolls
Wide Ram 4 Point Presses
Wire Drawers
Cut-Off Machines

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Telephone 216/531-1010 • Telex 980-186
FAX 216/481-6369