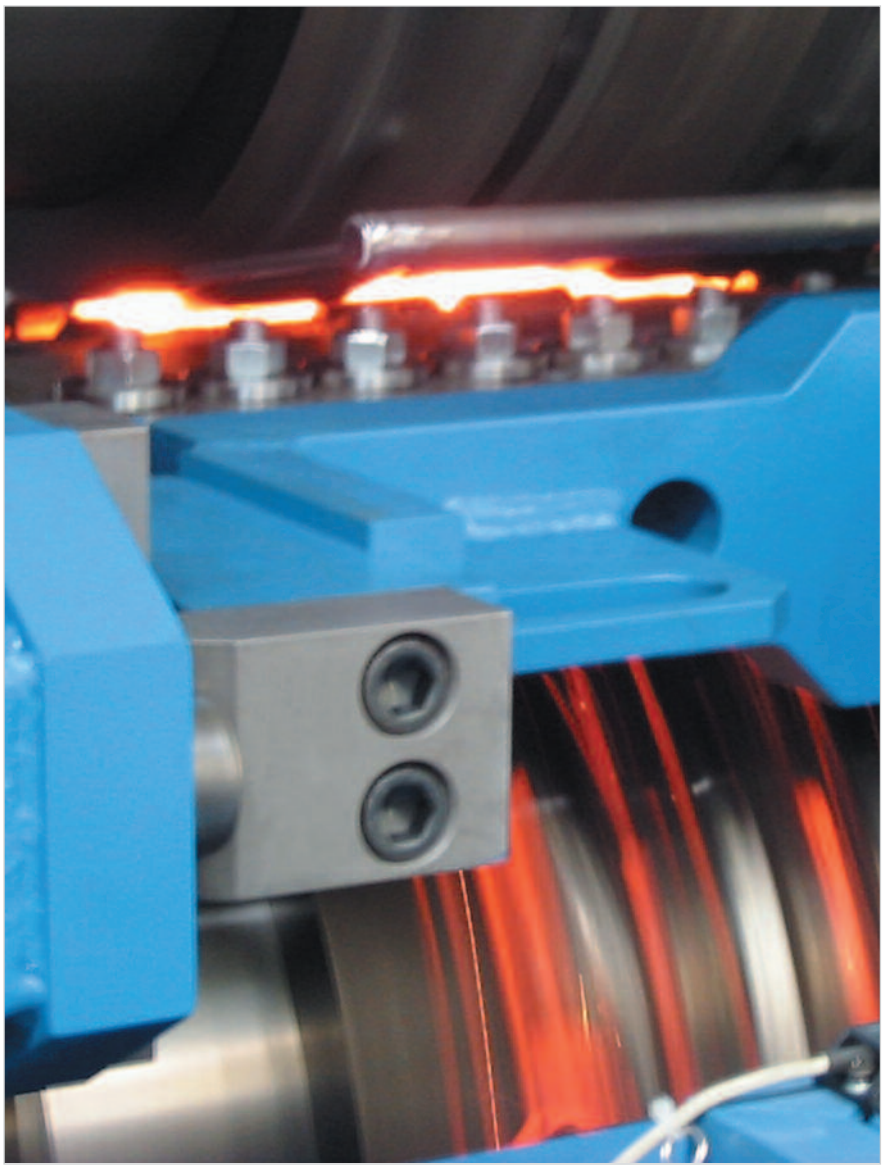
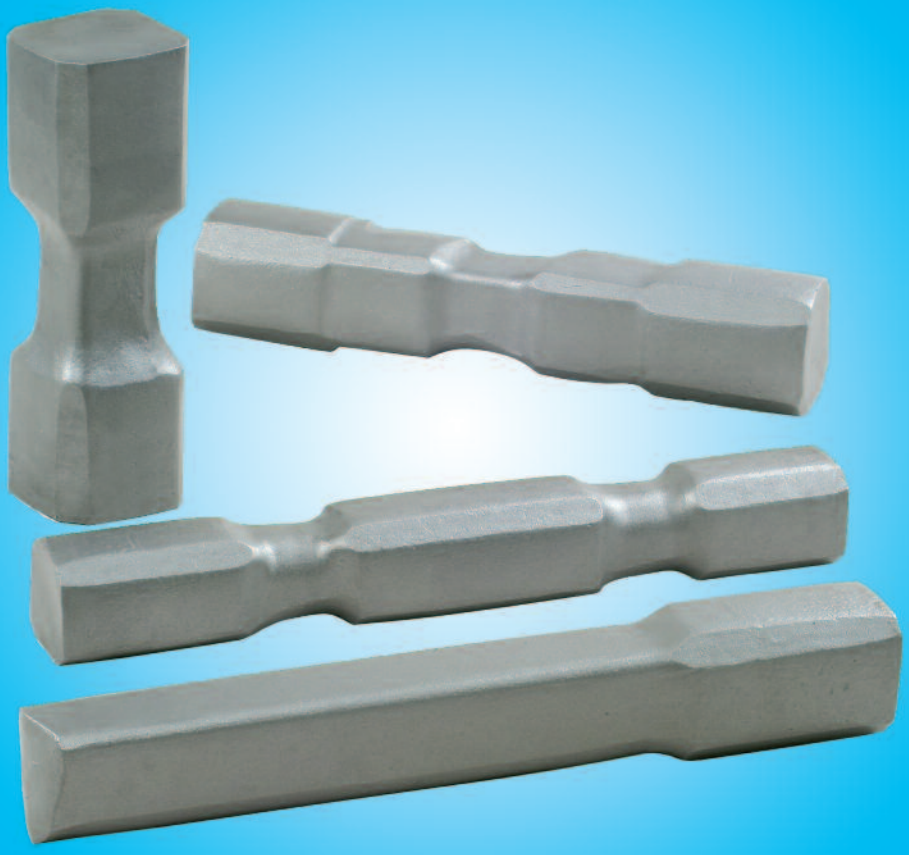
Solid Forming Machines

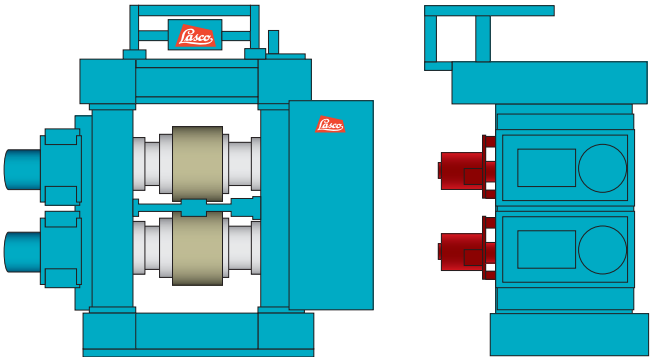
Cross-Wedge and Forging Rolls



LASCO UMFORMTECHNIK
WERKZEUGMASCHINENFABRIK

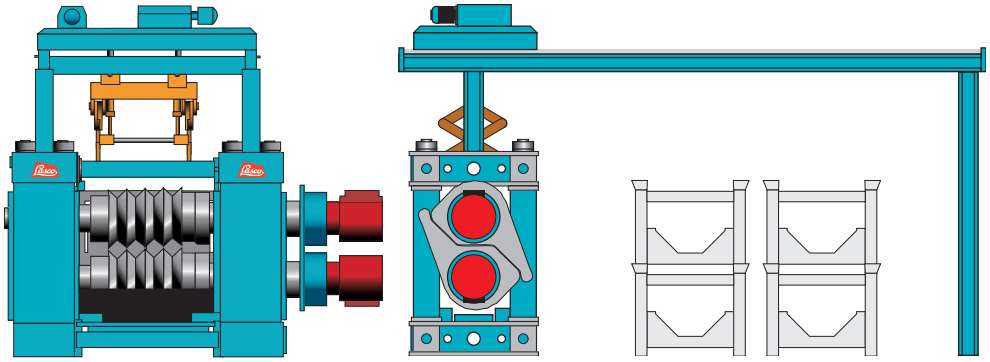


Series QKW and RCW



Schematic diagram of the QKW cross-wedge roll

QKW series		500	700	1000
Roller diameter	[mm]	500	700	1.000
Roller width	[mm]	500	700	1.000
Billet diameter max.	[mm]	50	70	110
Billet length max.	[mm]	300	400	560
Adjustment lower roller approx.	[mm]	40	60	80
Main-drive power per roller	[kW]	22	55	90
Roller tempering		optional	optional	optional
Width including feeding unit approx.	[mm]	3.000	5.000	6.200
Height approx.	[mm]	2.000	3.300	4.700
Depth approx.	[mm]	1.500	2.400	3.600
Weight incl. rollers approx.	[kg]	15.000	25.000	50.000



Schematic diagram of the RCW forging roll.

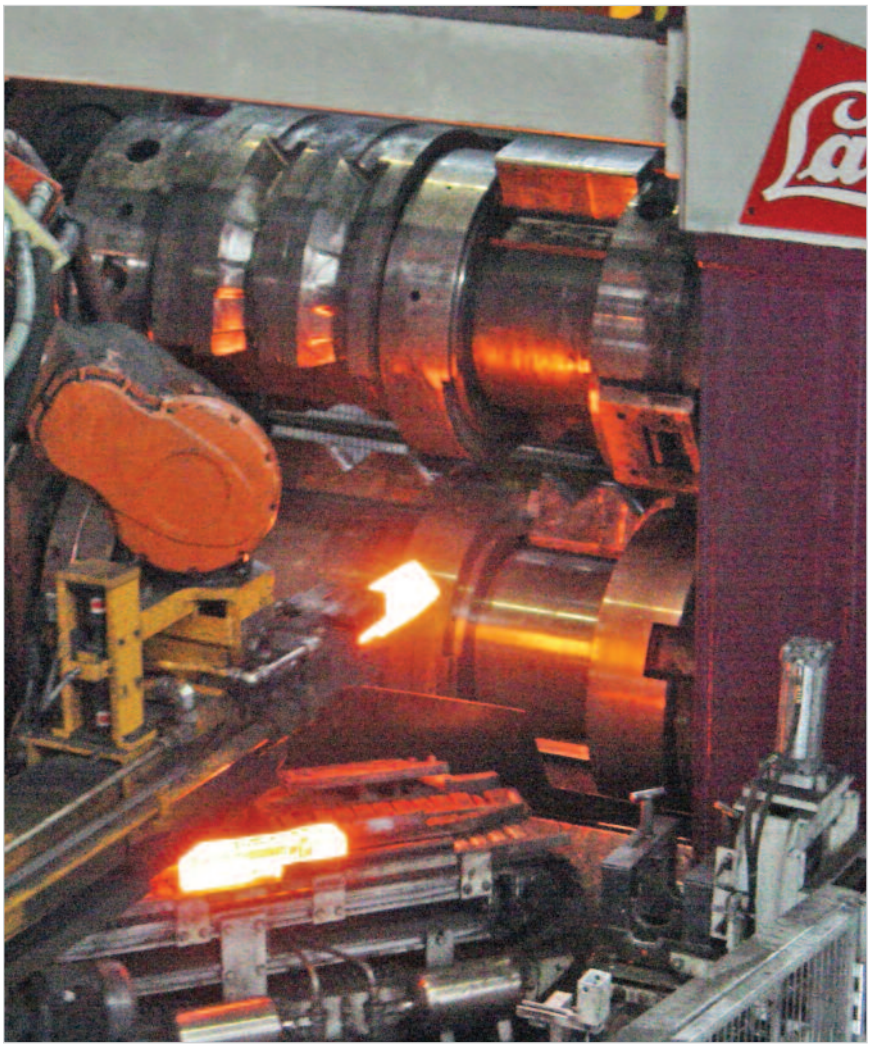
RCW series		460	560	930
Outer diameter of tool	[mm]	460	560	930
Clamping width of tool	[mm]	560	700	1.120
Thickness of billet max. square	[mm]	63	80	125
Length of billet max.	[mm]	315	400	630
Weight incl. tool approx.	[kg]	1.200	2.200	8.000
Adjustment of roller	[mm]	20	25	30
Main-drive power per roller	[kW]	125	200	500
Roller tempering		optional	optional	optional
Width approx.	[mm]	3.800	4.800	7.500
Height approx.	[mm]	1.800	2.300	3.500
Depth (without roller change manipulator) approx.	[mm]	1.200	1.500	2.400
Weight incl. rollers approx.	[kg]	15.000	25.000	100.000

■ Further models and sizes available on request

Near-net-shape Solid Forming

As a machine tool manufacturer, LASCO has concentrated since its beginnings on making available to users in industry and its related trades machines and equipment that provide solutions for metal-forming tasks. Our over 140 years of experience gained has given us the capability to offer production technology that is specially adapted to the rugged working environments of the metal-forming industry. Meanwhile, we can count over 1000 companies in our list of customers in 53 countries around the globe working in fields of all kinds.

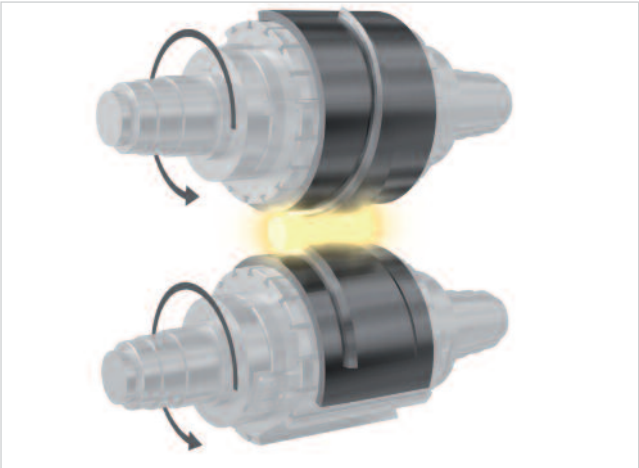
Mainly automated manufacturing cells can meet the growing demands for solid forming of forged parts with reproducible quality and the most effective use of materials. Closeness to final contours (near-net-shape) and efficient pre-forming of material are becoming increasingly important in these manufacturing cells. LASCO is meeting these market demands with its own product range, which includes hydraulic presses, drop-forging hammers, screw presses and automation technology, all coupled with its own machine concept for solid metal pre-forming using cross-wedge and forging rolls.



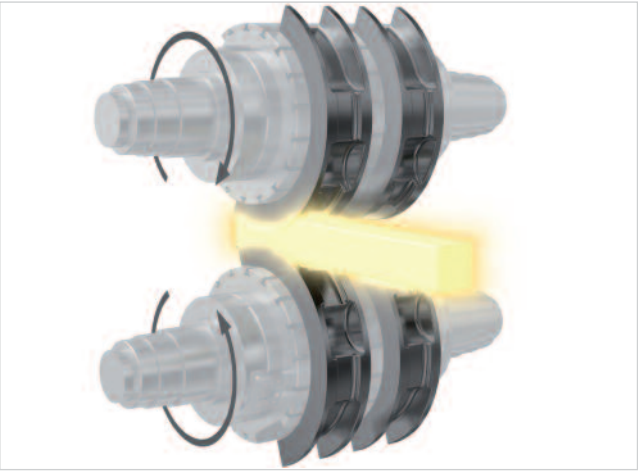
A LASCO RCW 900 forging roll integrated in a production line for crankshafts at a German automotive supplier.

Over 300 LASCO experts are united by one goal- to build the best machines for the success for their users.

Market Demands



Cross-wedge rolls – synchronous rotation. Axial workpiece feed.



Forging rolls – counter-rotation. Radial workpiece feed.

The various markets are continuously demanding ever-higher quality of forged parts for falling prices. One possible solution allowing suppliers to adapt to this trend is the automation of complete forging cells. LASCO has been supplying forging machines to its customers that offer the possibility of automation for many years now.

To be able to achieve the same degree of automation in material pre-forming using rolling machines, a new concept has been developed for pre-formed and finished part production.

Pre-forming lowers costs
The material cost element of unit costs for die forgings is 30 – 50 percent. For this reason alone, optimal pre-forming is essential to reduce these unit costs. The goal, therefore, is to achieve maximum closeness to the final form with the help of material distribution at an early stage of production. Good initial distribution of material reduces material flow later in the forging die, increasing the die's working life.

Two rolling processes
1. The **cross-wedge roll** is designed for the pre-forming and net-shape forming of symmetrically rotating steel and aluminium forgings. Hot, round rods are fed to the cross-wedge rolls and rolled between two synchronized rollers fitted with tools and preformed such that a workpiece is created having the desired shape.

Two guide rails are used to support the rods during the pre-forming process. The stationary workpiece rotates between the rollers and is positioned exactly in the geometric centre of the rollers. On completion of one roller rotation, the workpiece is ejected through an aperture in the rotating roll tool and transported away for further processing.

2. The **forging roll** is designed for the pre-forming of round and square material. In contrast to cross-wedge rolling, the blank is fed radially into the rollers by a manipulator and pre-formed in individual sectors (passes). The completed blank is then laid on a conveyor and fed to the main forming machine.

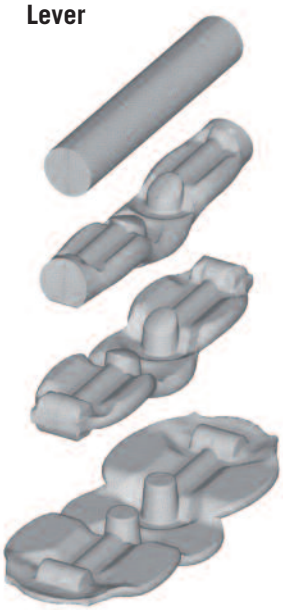
Both rolling processes offer a series of advantages:

- Considerable material savings.
- Improved workpiece surface because of descaling.
- Improved die life in subsequent forging because of descaling and reduction of material flow in the die.

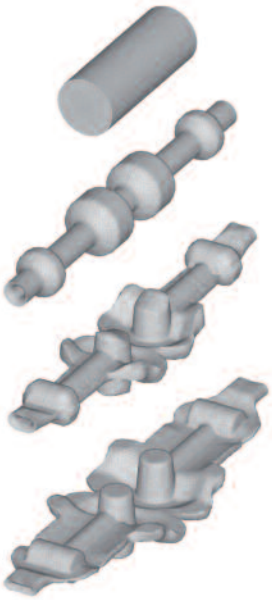
Efficient Material Distribution with Rolling Machines

Pre-Forming on Cross-Wedge and Forging Rolls

Lever

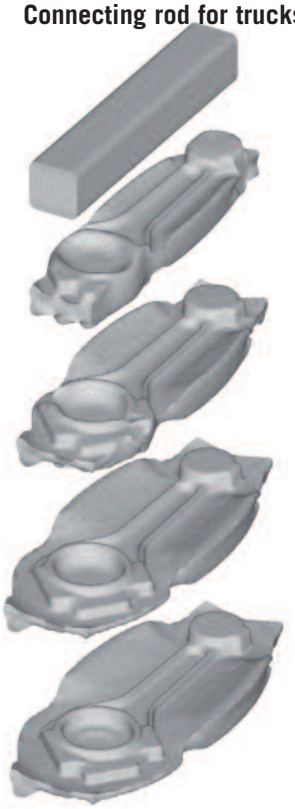


Without pre-forming machine
Material consumption: **100%**

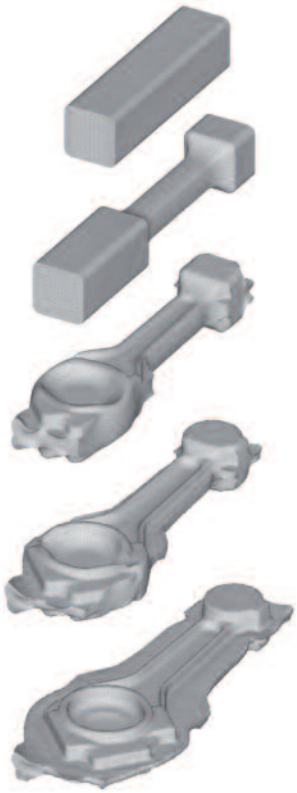


With upstream cross-wedge roll
Material consumption: **66%**

Connecting rod for trucks



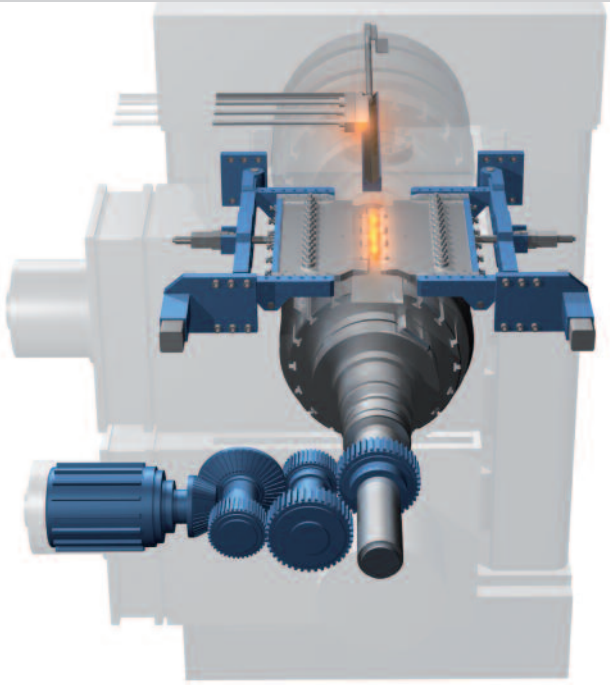
Without pre-forming machine
Material consumption: **100%**



With upstream forging roll
Material consumption: **67%**

The difference in material consumption becomes obvious in a comparison of the stages of a forming process with and without pre-forming with rolls.

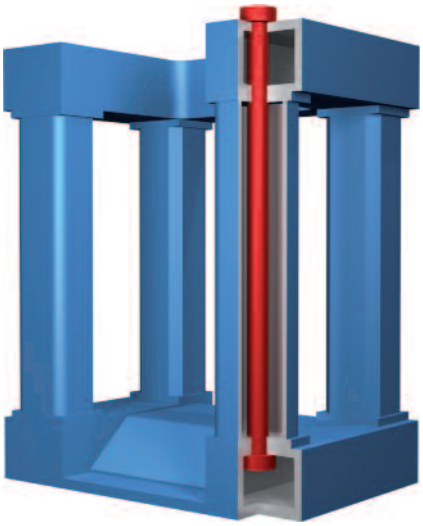
Fundamental Quality Features



Torque motors drive the rollers individually through compact speed reducers. Synchronization is achieved using a closed loop control system.

LASCO cross-wedge and forging rolls offer an abundance of innovative details that predestine these pre-forming machines for use in highly automated series processes and flexible production:

- Low maintenance requirement because of the omission of fixed transmission couplings and the coupling/brake combination. Programmable speed profiles allow adaptation to the forming task.
  Direct drive from a torque motor to each roller.
- Reliable absorption of forming forces and the thermal expansion induced by the process. Maintenance of narrow tolerances in the roller gap, thus increasing workpiece precision.
  High roll frame stiffness.
- No roller tension, short roller change times.
  Hydraulic clamping of the roller body.
- Roller change within 5 to 10 minutes depending on roller size.
  Roller change manipulator.
- High parallelism and precision of the roller gap maintains tight tolerances on the workpiece. Multiple tool resetting is possible.
  Measurement and automatic correction of the roller gap under operational load conditions; large setting range for the roller gap.
- Constant temperature ensures constant forming conditions.
  Optional tempering of rollers.
- Reliable repeatability of all engineering parameters.
  Programming of all product-specific machine parameters.



The roll frame: composite construction and pre-stressed with tie rods.

Base frame and roller arrangement
The roll frame is, depending on size, either a compound structure, pre-stressed by tie rods or a rigid single-piece welded frame. Solid bearing supports with spherical roller bearings for the rollers are incorporated in the frame. The rollers are synchronously height-adjustable through synchronous adjustment of the lower bearing support.

The guides for the bearing supports are welded into the frame and the guide rails are adjustable.

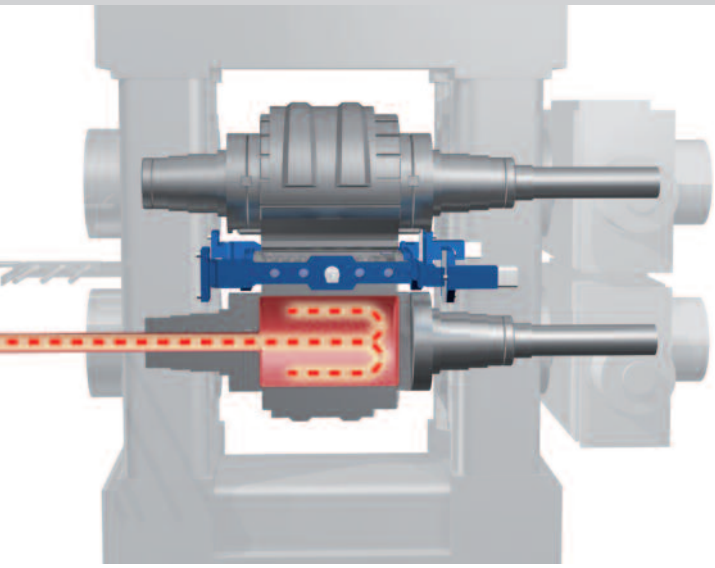
Direct drive
The main task in the design of the drives was the elimination of the fixed transmission coupling of the roller drives. The use of two separate torque motors each driving through compact speed reducers successfully solved this problem.

The high dynamics and control accuracy of the motors allow the programming of speed profiles.

Both rollers are provided with absolute shaft encoders for measurement of shaft angle, so that start and tool change positions can be automatically approached. The controller can also make tool angle corrections.

The basic concept with its separate roller drives allows changes in the direction of rotation **(synchronous or counter rotation)**. This makes possible the use of cross-wedge or forging rolls with practically the same method of construction. A combination roll design using both processes is also possible in special cases. This provides the user with substantial advantages when a change in the product range is necessary.

Pioneering Solutions



Temperature control of the rollers.

Hydraulic roller clamping.

The drive unit was simplified considerably in comparison with conventional drives, a fact that was extremely advantageous for the operation, setup operations (roller changes) and machine maintenance.

Bearing supports
Each roller is supported at each side by twin-row spherical roller bearings designed for extra reliability. The bearings in the right-hand upright can be recessed hydraulically for a roller change so that the adapters can be freed and the rollers removed without tools by an integrated changing device.

During operation, the rollers are clamped hydraulically in the axial plane. This hydraulic cushion also serves to compensate for thermal expansion in the roll frame. This successfully eliminates axial roller tension.

Bearing cooling and lubrication
Depending on size, the bearings are lubricated either by oil circulation or with grease. The oil conducts away the heat that enters the system via the rollers. This stabilizes the temperature in the bearing supports.

Rollers
The rollers are fitted with cross keyways that ensure precise fixing and centralizing in the machine. The torque needed for the forming process is applied through stable drivers on the rollers. The rollers themselves are made of forged, annealed, tempered steel. The tools are attached to the roller periphery using T-slots.

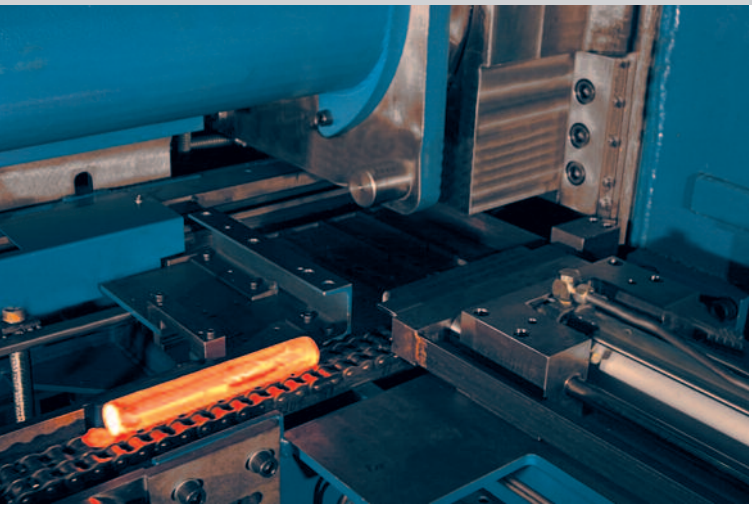
Hydraulic roller clamping
No auxiliary tools are needed during automatic roller clamping. The rollers are hydraulically clamped and locked, which ensures a high degree of safety. A roller change is completed in a very short time.

Roller change manipulator
LASCO rolling machines can be optionally fitted with a fully or semi-automatic roller change manipulator, which lifts the rollers out of the machine with lifting gear. This device is designed with two cable reels that keep the rollers positioned centrally. Travelling and lifting gear are provided with creep and fast speeds.

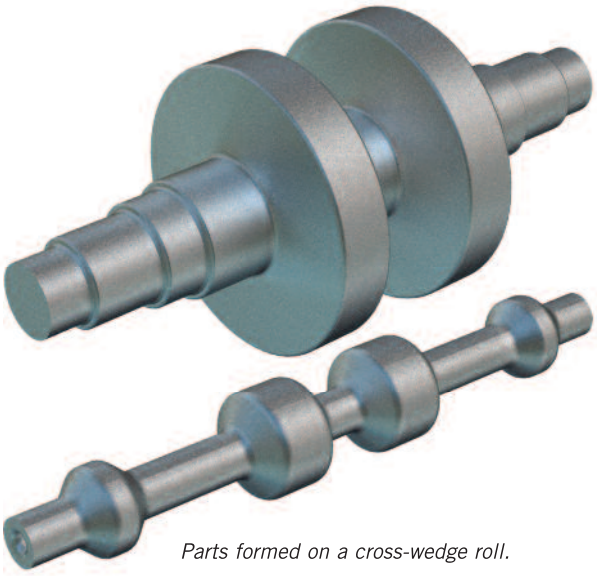
The motors are driven by a frequency converter that ensures that all movement is soft and harmonious. Using this system in conjunction with hydraulic clamping, a roller can be changed within approximately 5 to 10 minutes.

Temperature control
The use of the temperature control option is recommended for sensitive materials such as aluminium alloys. The rollers are heated to the desired temperature either with preheated thermo oil circulating in a closed circuit system or internally by electric heaters.

Fully Automated Cross-Wedge Roll...



Automatic workpiece feed.

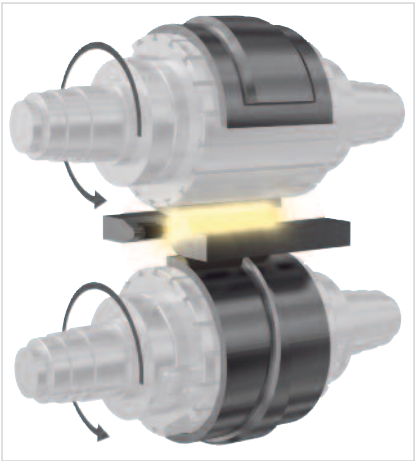


Parts formed on a cross-wedge roll.

The **LASCO QKW cross-wedge Roll** is designed for fully automatic operation as a pre-forming machine in forging line series production. Basically, however, it can also be employed as a stand-alone machine. It is especially suited to the pre-forming and finish forming (material distribution) of rotation-symmetrical billets of steel and aluminium.

The process
Round, heated billets are fed to the cross-wedge roll and rolled through between two synchronized rollers fitted with tools and formed. On completion, the workpiece is ejected through an aperture in the rotating lower roller and transported away for further processing.

Guide rails
During forming the workpiece rotates freely – in the opposite direction to roller rotation.Two guide rails are used to support the round rods in the correct position during the pre-forming process.



Guide rails (shown here schematically) keep the rolled workpiece in its central position.

The rails are fitted with overload protection in the form of reversible flap devices. Control sensors detect any irregular occurrences during operation and the workpiece is ejected before the forming equipment can be damaged in any way.

Optionally, the rails can be fitted with hydraulic drives that retract them just after the start of rolling.

Roller gap adjustment
The roller gap adjustment is set up by synchronous adjustment of the two lower bearing supports using two servo-driven, positionable spindle drives.

The system is provided with measuring equipment having high-resolution absolute sensors that monitor the position of the rollers during operation and automatically correct the gap by adjusting the spindle drives, compensating for mechanical and thermal changes.

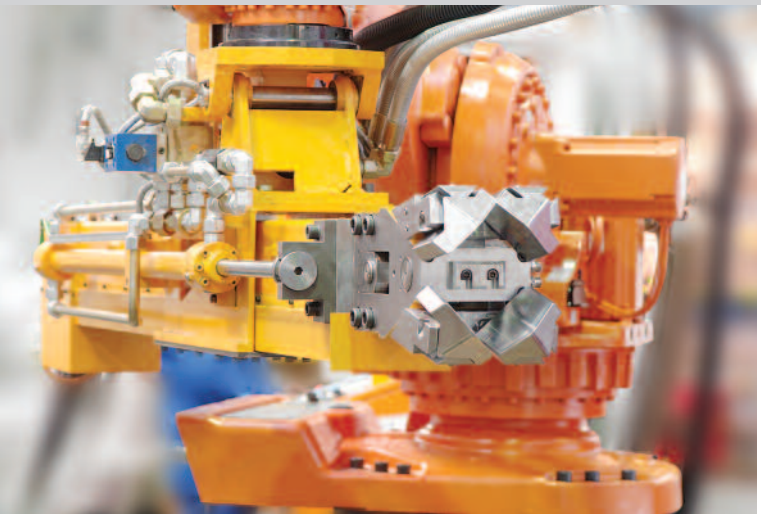
... with Short Set-up Times

Workpiece feed
The heated blanks are taken up by a chain feed and pushed into the transverse conveyor. This is provided with a reject point controlled by sensors that separate blanks with too low a temperature. The transverse conveyor pushes the blank into a guide system and a servo driven rod pushes the blank axially into the start position of the forming process.

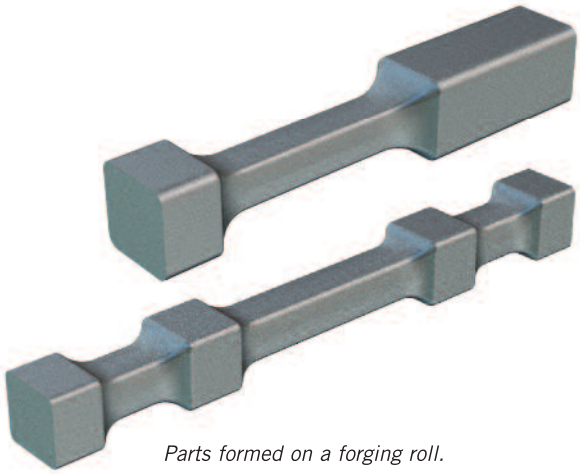
Roller change manipulator. A roller is changed in less than five minutes.

Schematic representation of a LASCO QKW 700 cross-wedge roll with feed guide system.

Forging Roll with Flexible Drive System...



Forging roll manipulator with special gripper and compensators.



Parts formed on a forging roll.

LASCO RCW series forging rolls are designed such that the stretching process is completed in several passes (roller groove). The blank entering from the heating unit is fed sequentially to the individual passes by a forge-rolling manipulator. The blank is preformed analogous to the contours of the individual roller grooves. Between the individual passes the forging roll manipulator arbitrarily rotates the blank by up to 180° around its longitudinal axis.

As the rollers can be removed from the forging roll for a tool or groove change, it is possible to work with completely circular, closed roller grooves and/or with grooves in the form of circular segments.

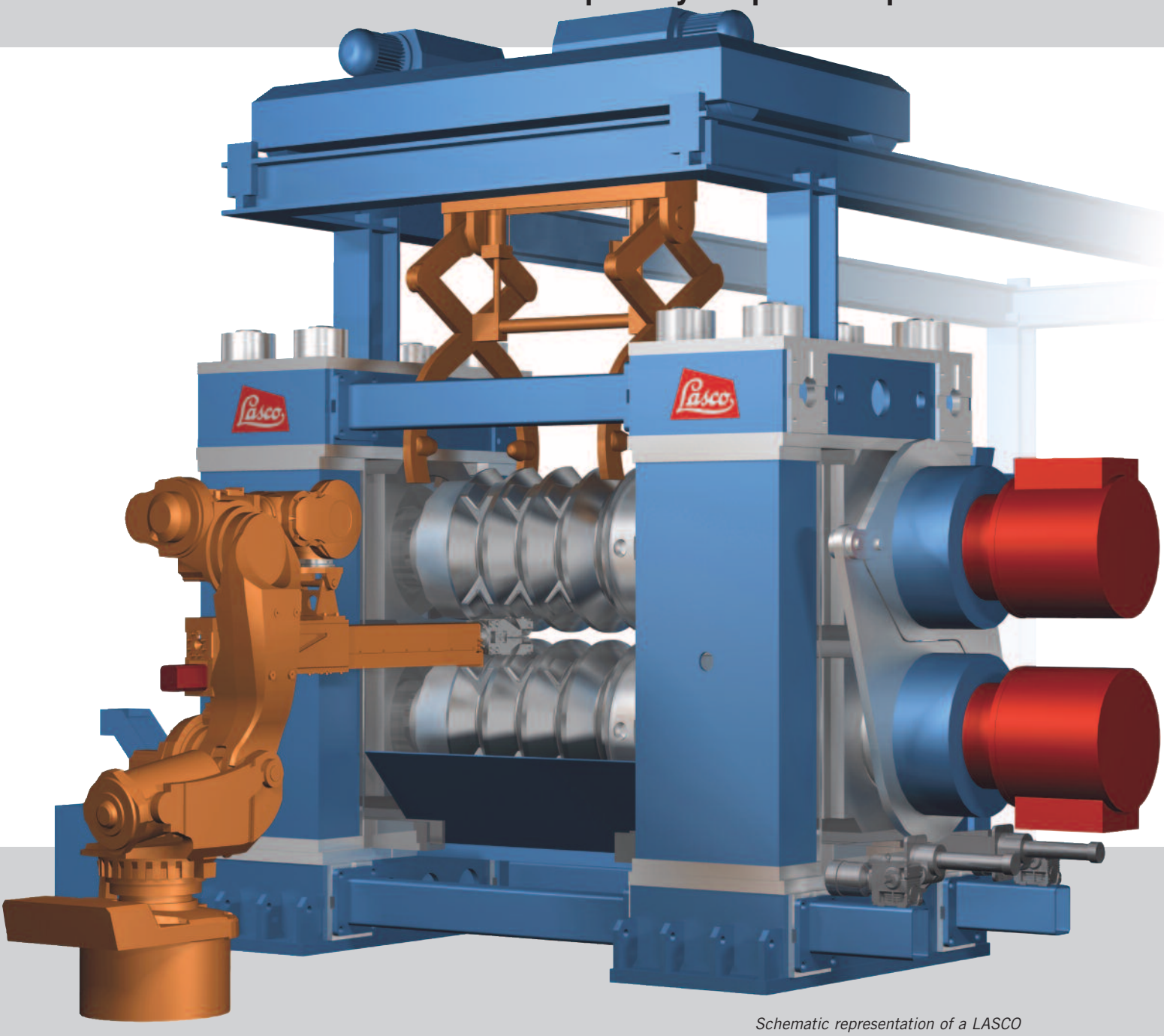
Special forging roll manipulator
To be able to take advantage of all the benefits of the flexible drive system, a specially modified industrial robot is used as a manipulator. The LASCO manipulator gripper is fitted with a compensating member that balances out the changes in blank length caused by the forming process and a further compensating member that prevents the reactive forces resulting from the forming process affecting the robot.

This allows feed and discharge of the blank to be just as flexibly arranged because the freely programmable forging roll manipulator is not tied to a fixed sequence of movement.

The manipulator and the rollers work in a master-slave mode during the rolling process with the angle of roller rotation acting as the master signal. This mode of operation allows shock-free working and ensures almost zero wear compared to mechanical, rigidly coupled drive systems.

Highly dynamic and precisely positioning servo motors drive the forging roll manipulator. Its movements are synchronized with the servo drives of the rollers so that the stretched workpiece is moved according to the prevailing peripheral speed of the rollers. This means that during operation the speed of workpiece movement is matched to the speed profile.

...and Specially Adapted Manipulator Robot

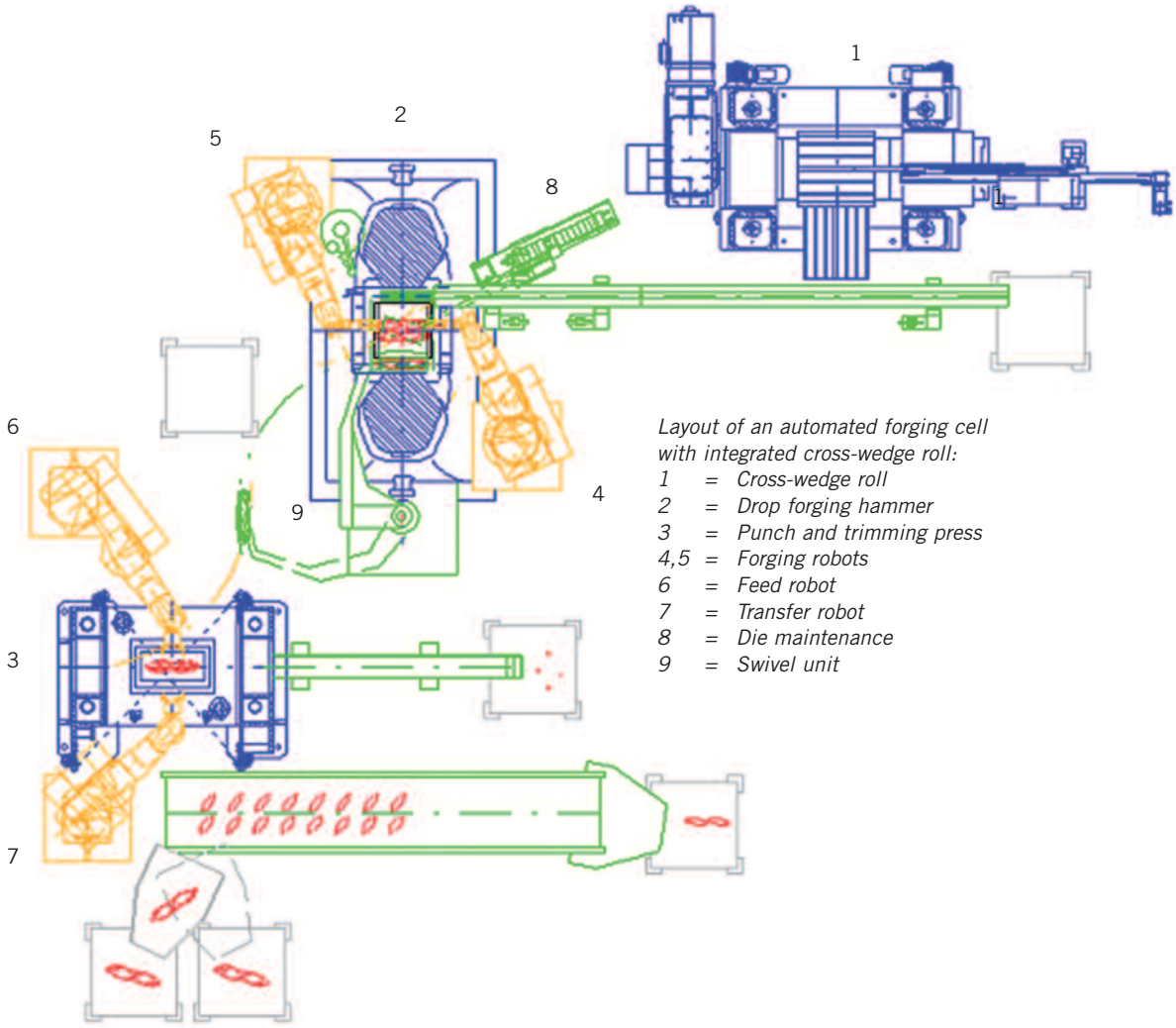


Schematic representation of a LASCO RCW 900 forging roll with manipulator.

Tried and tested components
All the advantages of LASCO cross-wedge rolls such as roller change manipulator for fast tool change and roller temperature compensation are available on the LASCO RCW series.

Flexible multi-purpose roll
LASCO is the only manufacturer that has implemented a concept for rotational press forming that allows both forge rolling work and cross-wedge rolling work to be carried out in one machine. This unique and outstanding flexibility has been made possible using the principle of directly driven rollers in synchronous or counter rotation.

Cross-Wedge Rolling in the Automated Hammer Forging Process



Layout of an automated forging cell with integrated cross-wedge roll:
1 = Cross-wedge roll
2 = Drop forging hammer
3 = Punch and trimming press
4,5 = Forging robots
6 = Feed robot
7 = Transfer robot
8 = Die maintenance
9 = Swivel unit

The advantages that can be gained by integrating LASCO rolling machines into an automated process chain are shown by a practical example of an automated hammer forging production line working with a cross-wedge roll.

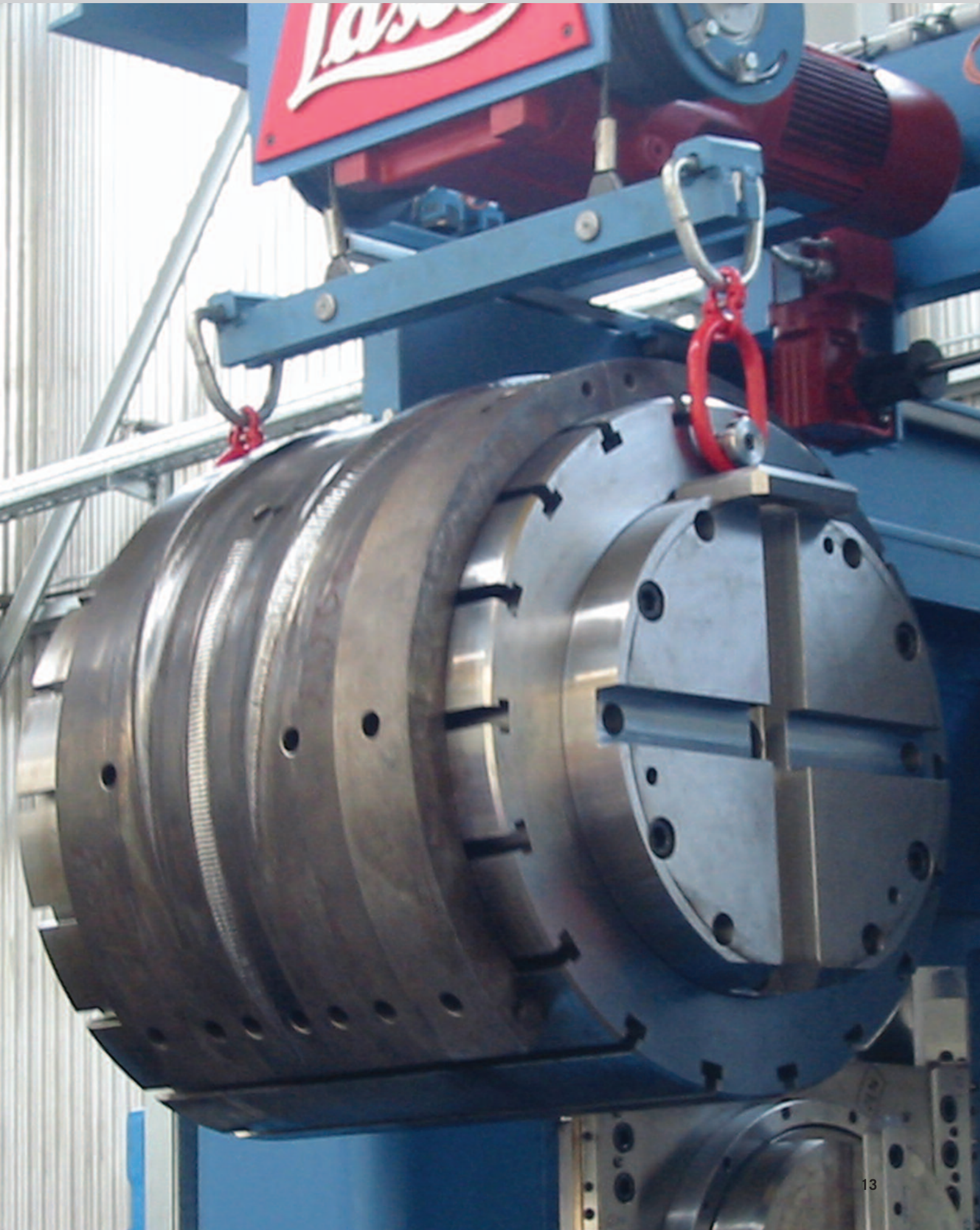
Cross-wedge rolls can be integrated into automated forging lines to high advantage because of their continuous cycle of operations.

Cross-wedge pre-forming not only saves material but also reduces the number of operations and hammer blows in the main forging machine – in this example a drop-forging hammer – which results in a significant reduction of cycle times.

In the example the billet is fed from the heating unit to the input of the cross-wedge roll and then, after the rolling process, laid directly on the conveyor feeding the working area of the hammer.

The precisely positioned workpiece is picked up by the forging robots and fed to the individual processes. The finished part is laid on a swivel arm that positions the part in front of the trimming press. Two further trimming robots accept the part and place it in the punch and /or trimming tool. A bypass is installed between the heating unit and the hammer for parts that are not to be pre-formed.

Automatic Roller Change



LASCO's Added Value

Experts in sales, design, production, assembly and service make it possible for LASCO to react flexibly and comprehensively to the needs of its customers.

Perfectly harmonized solutions from a single source

Our experienced experts design all the components of a production line that have a decisive effect on product quality here in-house. Because of the flexibility and fast decision-making capabilities of a medium-sized company this makes it possible to react comprehensively to customer needs and to offer perfectly harmonised solutions from a single source.

Complemented by our personal presence around the globe, LASCO can offer its customers services that have set standards in the world market.

LASCO's workforce, working together in interdisciplinary teams, will find the optimal solution to your forming requirements.

October 2012

www.lasco.com

Headquarters:
LASCO Umformtechnik GmbH
Hahnweg 139
96450 COBURG
GERMANY
Phone +49 9561 642-0
Fax +49 9561 642-333
E-mail lasco@lasco.de
Internet www.lasco.com

LASCO FRANCE
1, allée des Cèdres
78860 SAINT NOM LA BRETÈCHE
FRANCE
Phone +33 1 3080-0528
Fax +33 1 3080-0584
E-mail thierry.lebailly@lasco.de

LASCO USA
LASCO Engineering Services L.L.C.
615 Harbor Avenue
MONROE, MI 48162
USA
Phone +1 734 241-0094
Fax +1 734 241-1316
E-mail lasco@lascoUSA.com
Internet www.lascoUSA.com

LASCO CHINA
LASCO (Beijing) Forming Technology Co. Ltd.
Huateng Tower, Unit 1706A
Jia 302, 3rd Area of Jinsong,
Chaoyang District
100021 BEIJING
P.R. CHINA
Phone +86 10 8773 0378
Fax +86 10 8773 0379
E-mail lasco.beijing@lasco.de

LASCO UMFORMTECHNIK
WERKZEUGMASCHINENFABRIK