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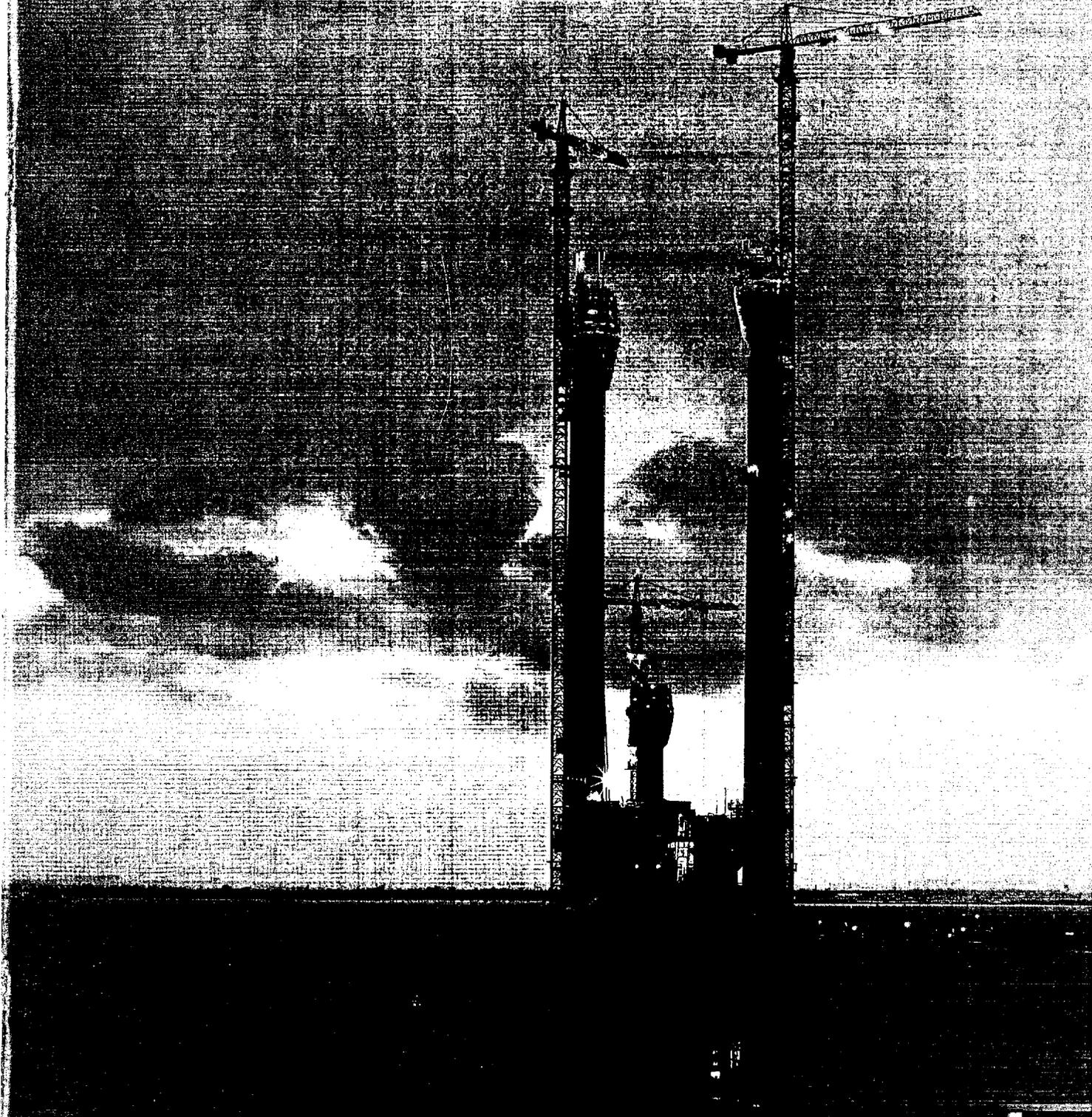
LIEBHERR-WERK BIBERACH GMBH

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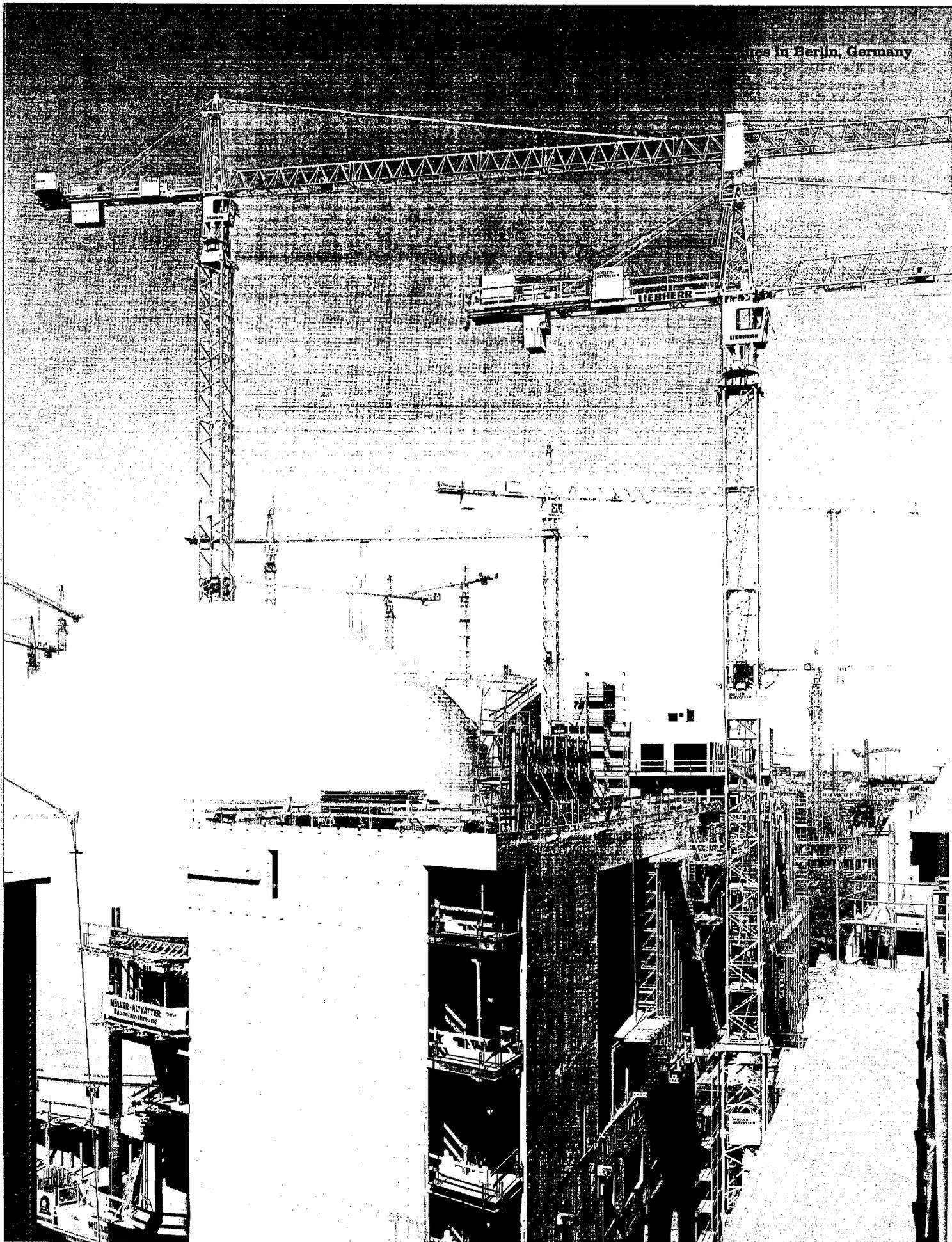
Detailed informations please take
out of the following brochure.

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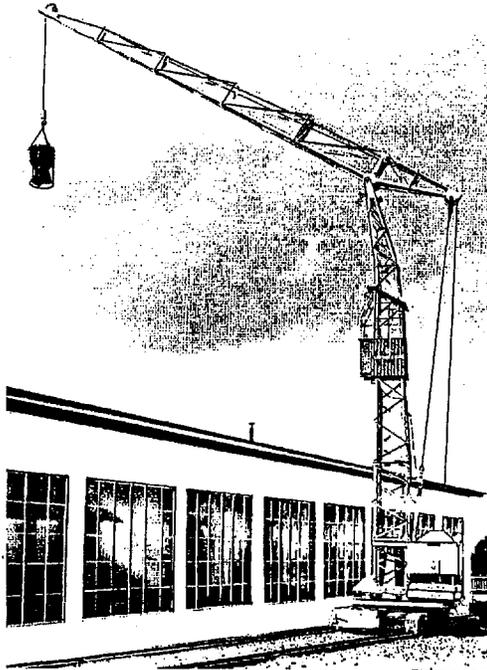
Liebherr-Werk Biberach GmbH.



LIEBHERR



It began in 1949 Liebherr tower cranes.



TK 8, built in 1949

EC-H cranes during construction of the Millennium Tower in Vienna, 1999



In 1949 crane construction reached an important turning point. Hans Liebherr, founder of the company that bears his name, had noticed that there were no easily erected, transportable tower cranes available for the major construction tasks of the day. He put his ideas down on paper, steadily improved them, had drawings made up, did some more design work and started to build.

In 1949 Hans Liebherr exhibited his first construction crane to the general public. The crane production plant that was set up back then marked the beginning of Liebherr's history as an industrial company.

Not only did this lead to a very wide range of cranes but also, as time progressed, to a comprehensive range of construction machinery which is now the largest in the world.

Many of Liebherr's innovations and its proficiency pointed the way to the future in crane construction. Liebherr offers a range of cranes that is second to none. There are models for all systems and size categories, indeed for every possible application. To date, more than 80,000 cranes have left Liebherr's production lines.

Liebherr-Werk Biberach GmbH.

Liebherr-Werk Biberach GmbH builds tower cranes of all systems and in every size category: bottom-slewing fast-erecting cranes with solid-walled or lattice towers, easily erected top-slewing cranes with trolley, cantilever, fly, telescopic, articulated, folding or special-purpose jibs.

Liebherr cranes can be used in any number of ways and are therefore particularly economical. They can operate as climbing cranes inside or outside high buildings, or be used on fixed foundations, screw jacks, rails, wheels or crawler tracks. They can also be permanently mounted on crawler-track undercarriages or attached as a piggy-back system.

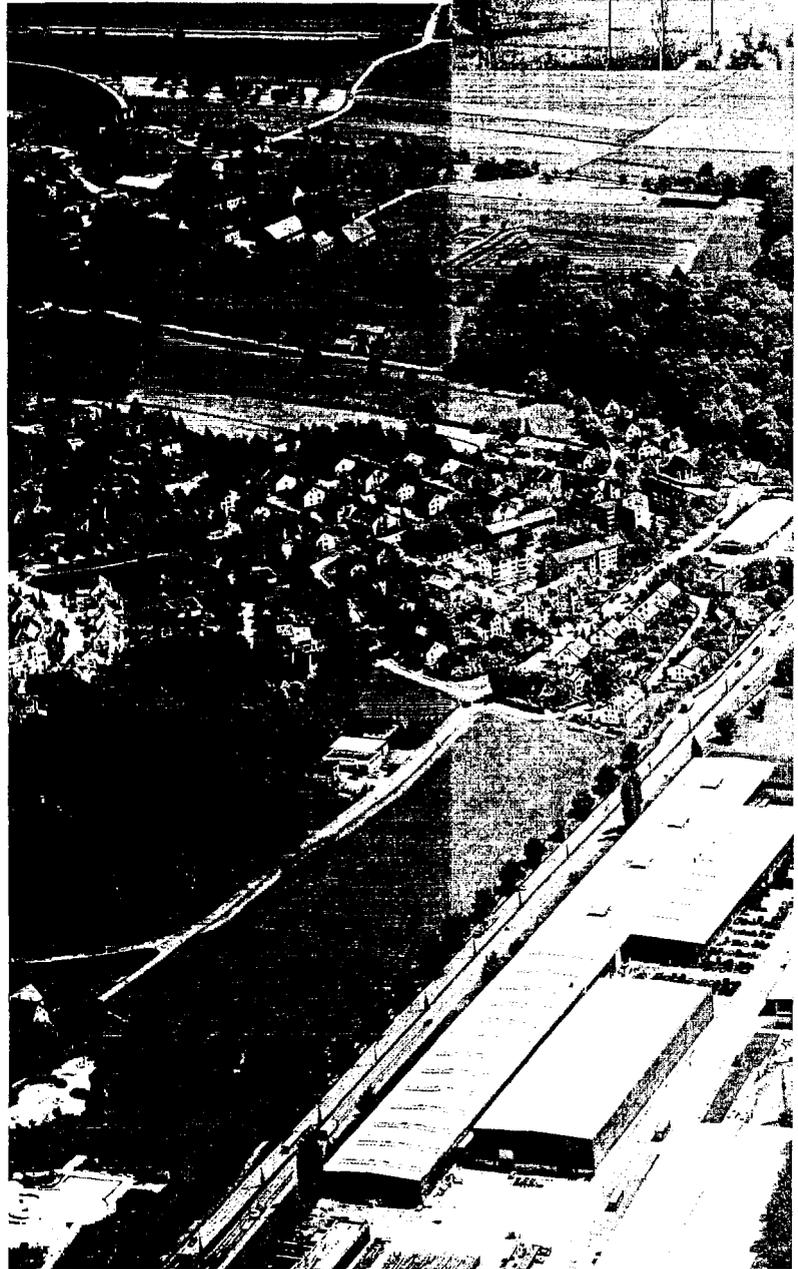
For design and quality reasons, Liebherr has for many years practised a policy of making a high proportion of its components itself. Its high quality and proficiency in the development, design and production of gears, electric motors, large ball and roller bearings, slewing gears, switchgear cabinets and Litronic function modules has led to Liebherr Biberach plant not only designing and manufacturing these parts for its own use, but for also other members of the Liebherr Group and for external companies.

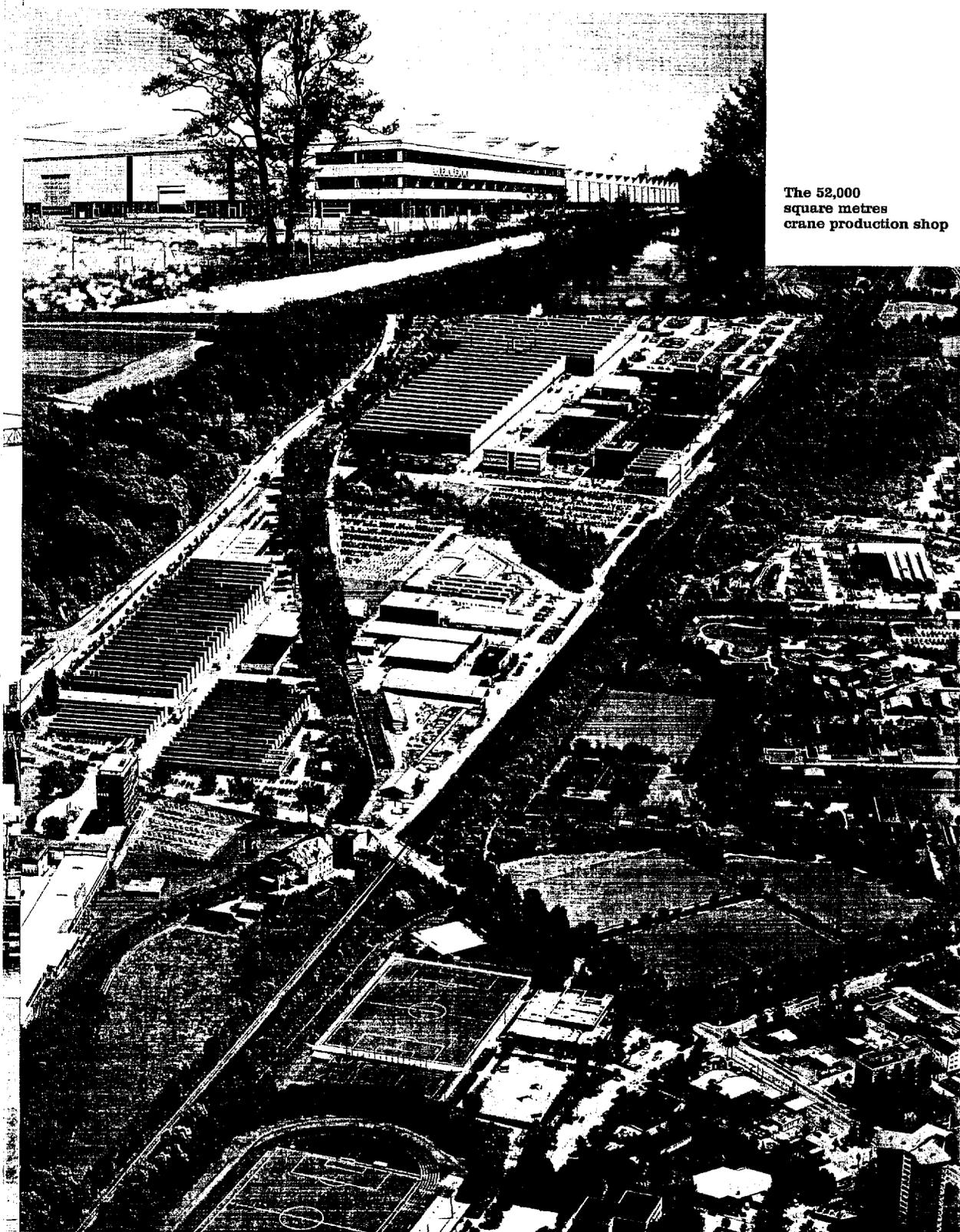
The plant in Biberach, which stands on a 36-hectare site, was built in several stages and includes production, administration and catering facilities in buildings that cover more than 140,000 square metres.

Around 1,600 employees use the latest technologies to develop and manufacture tower cranes and components that point the way forward to tomorrow's needs.

Liebherr was the first crane manufacturer to be certified in accordance with the DIN EN ISO 9001 standard.

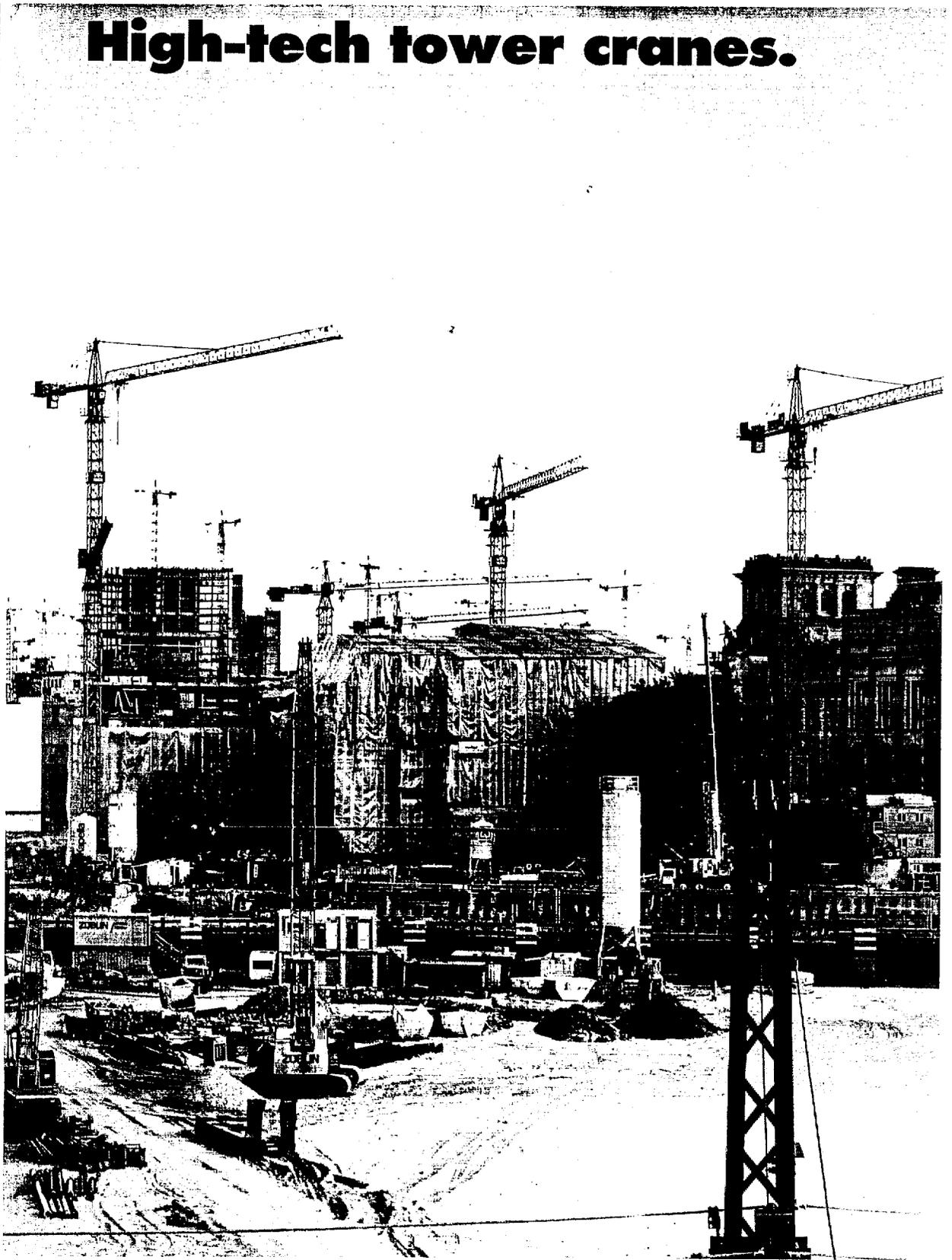
Crane-technology requirements are constantly increasing and Liebherr will use its innovative skill and modern technology to rationalise construction methods in an economic manner.

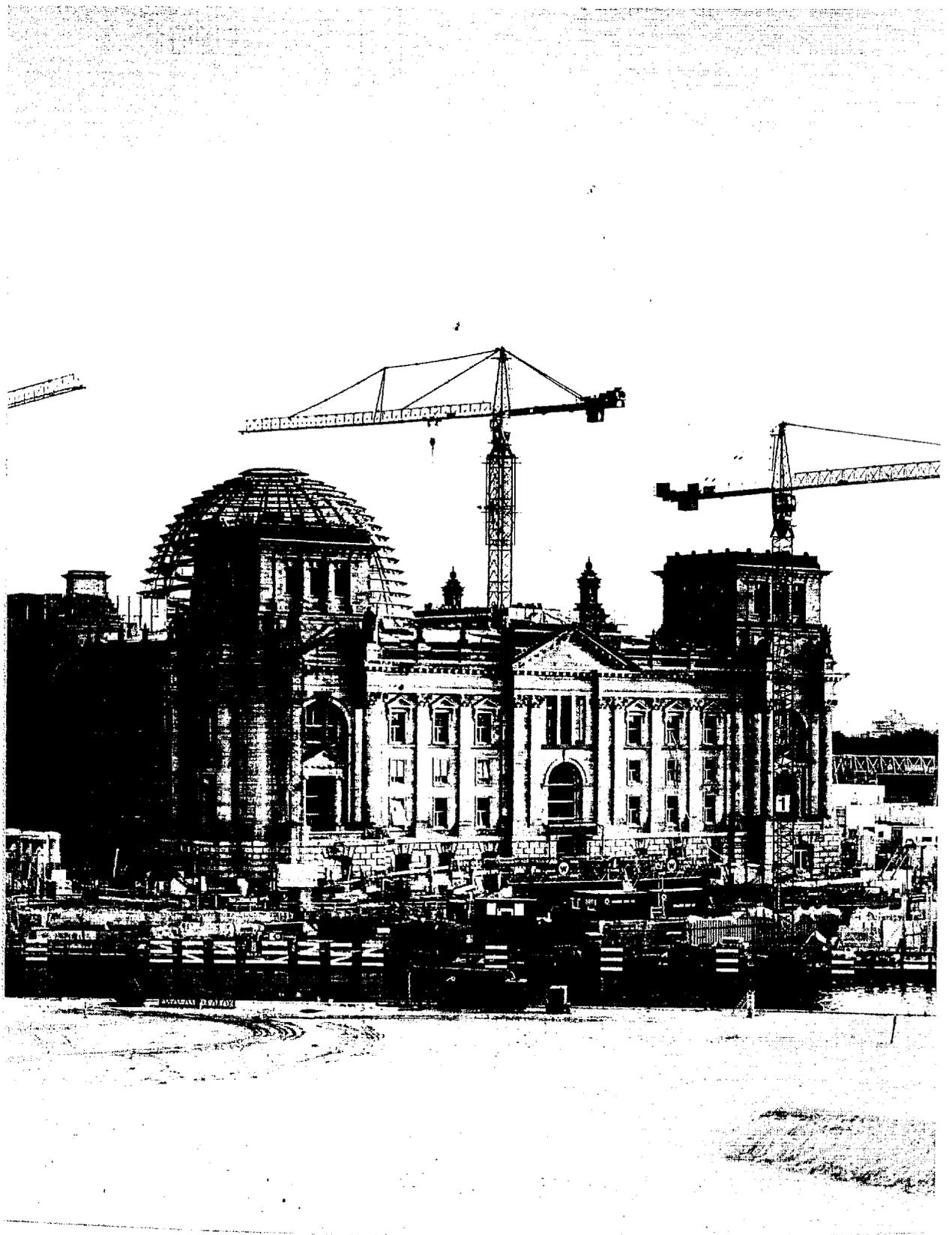


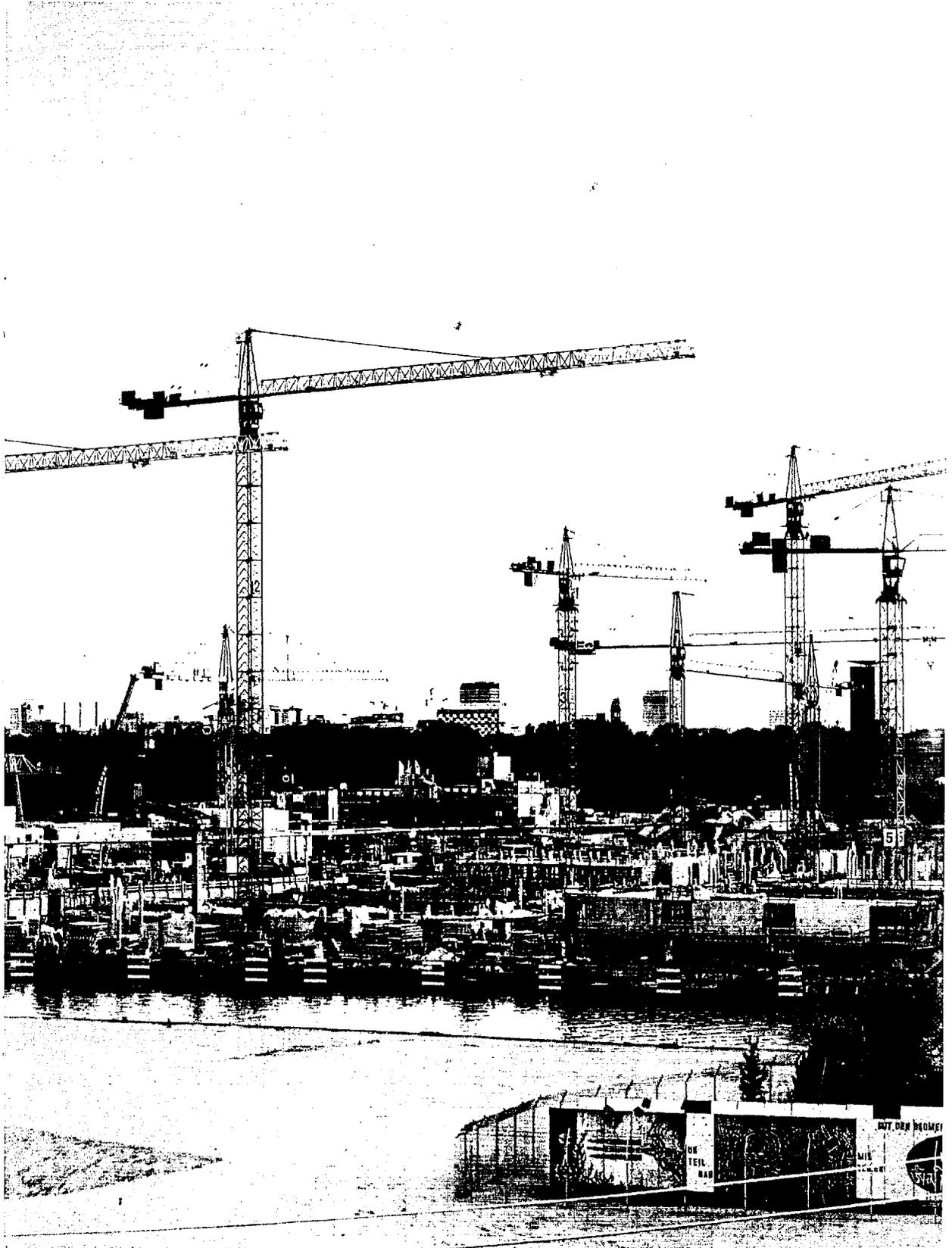


The 52,000 square metres crane production shop

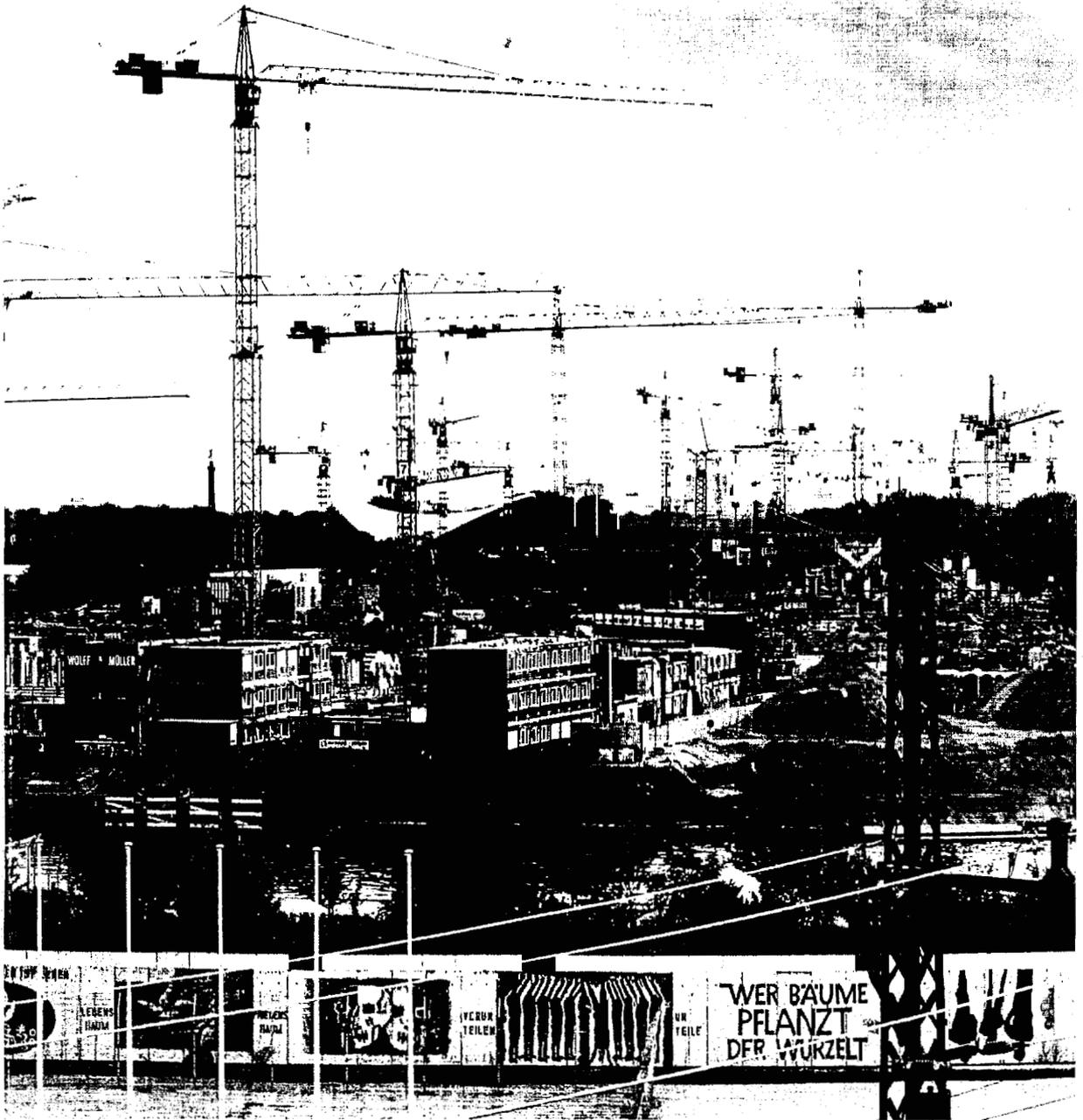
High-tech tower cranes.



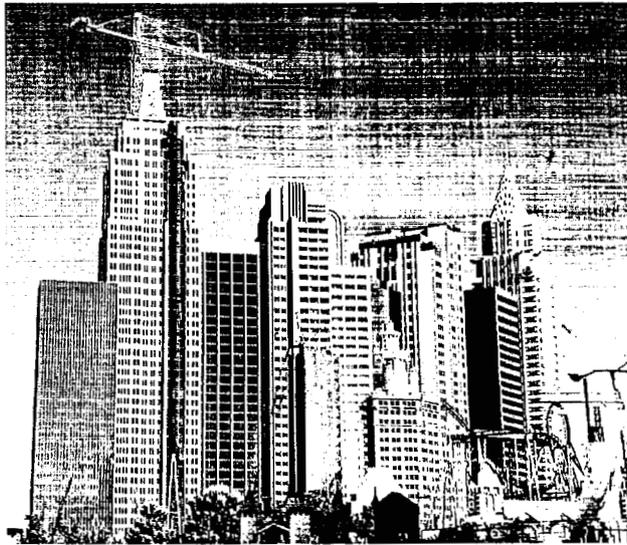




Liebherr tower cranes from the EC, EC-H and HC series at work on projects in Berlin

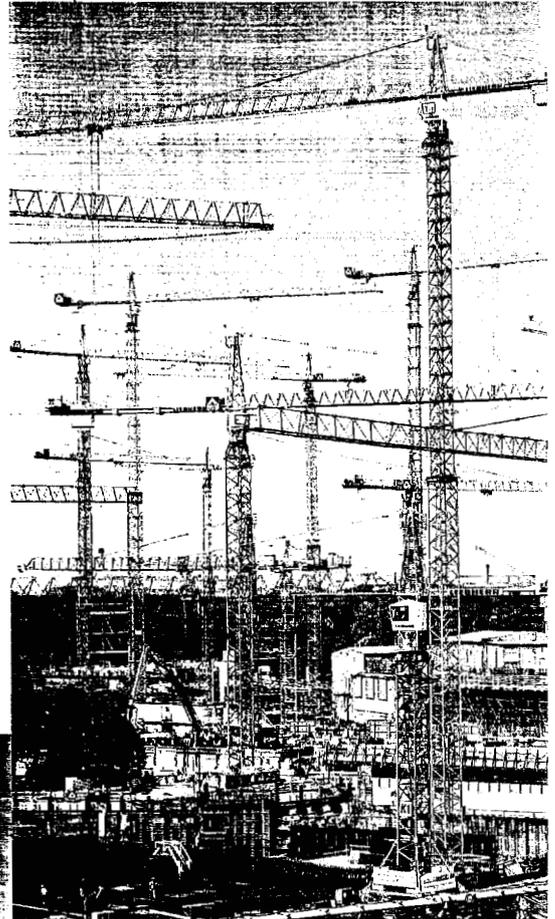
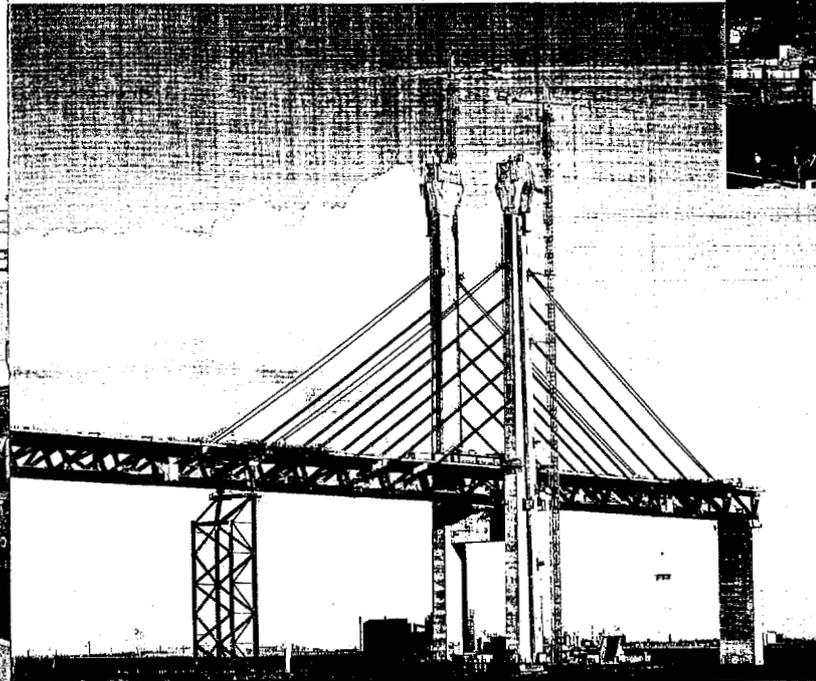


Liebherr tower cranes on the world's construction sites.

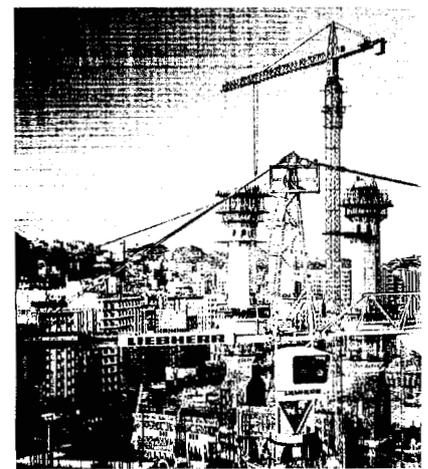


HC crane in Las Vegas, USA

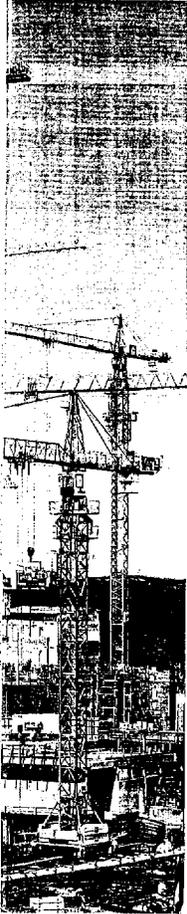
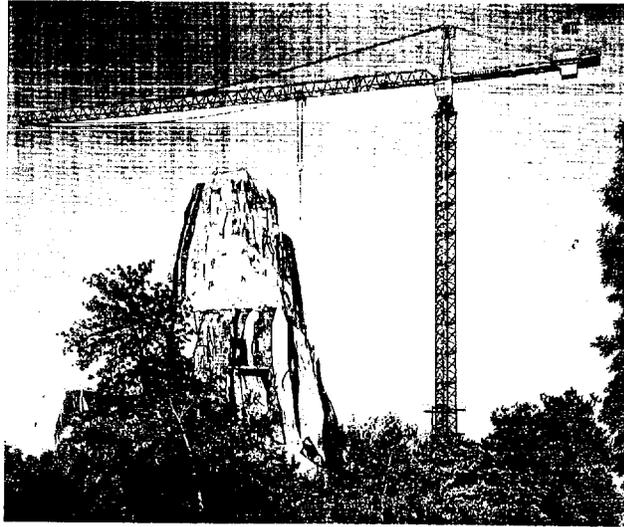
EC-H cranes on the bridge-building site in Øresund, Denmark/Schweden



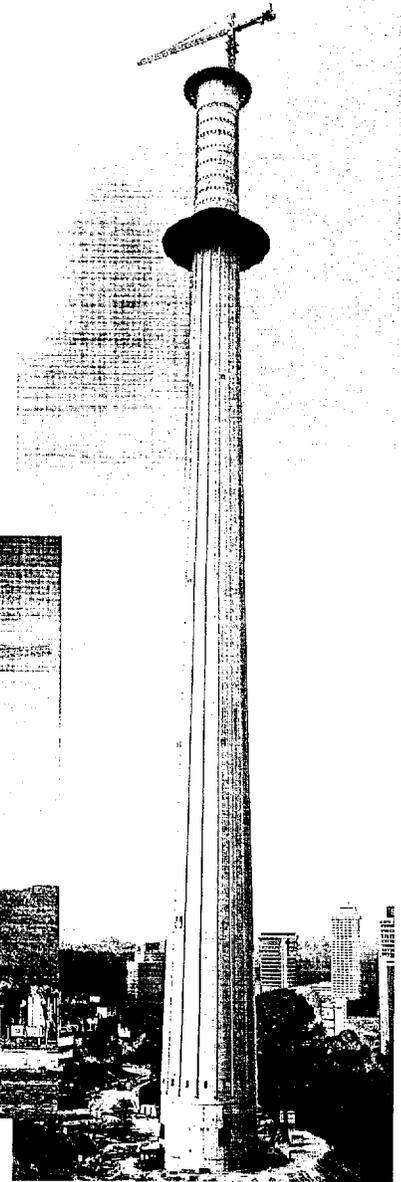
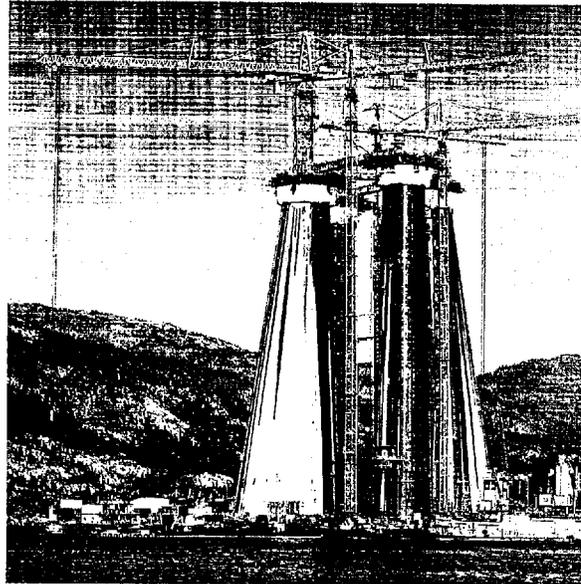
EC-H cranes in Berlin, Germany



**EC-H cranes at
the Vincennes
Zoo in Paris,
France**

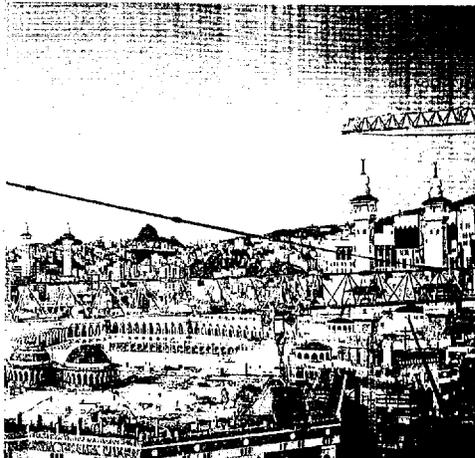


**HC cranes
on the Troll
oil-platform
project in
Norway**

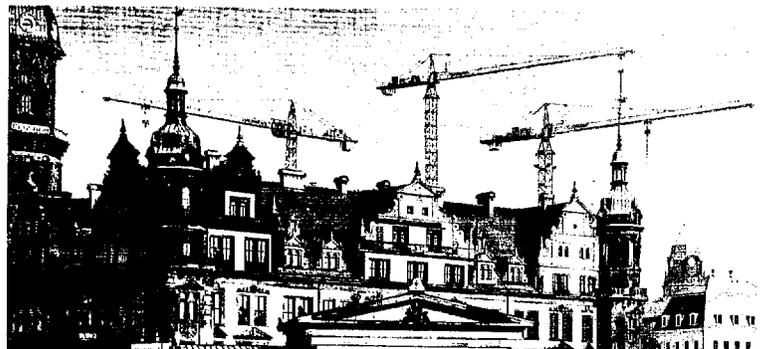


**HC crane on TV tower in
Kuala Lumpur, Malaysia**

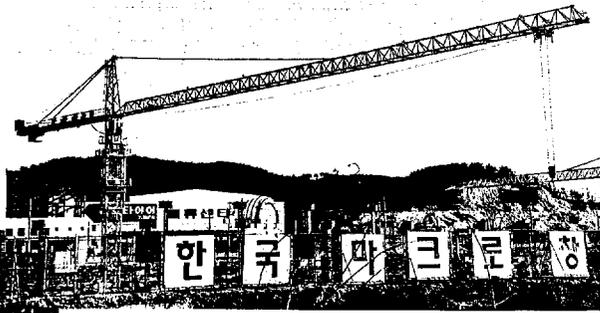
**HC and EC-H cranes in
Mecca, Saudi Arabia**



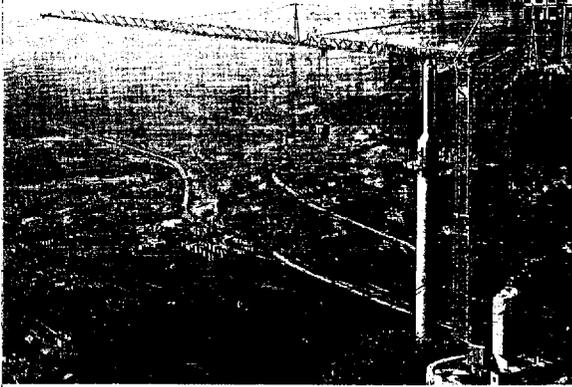
EC cranes in Dresden, Germany



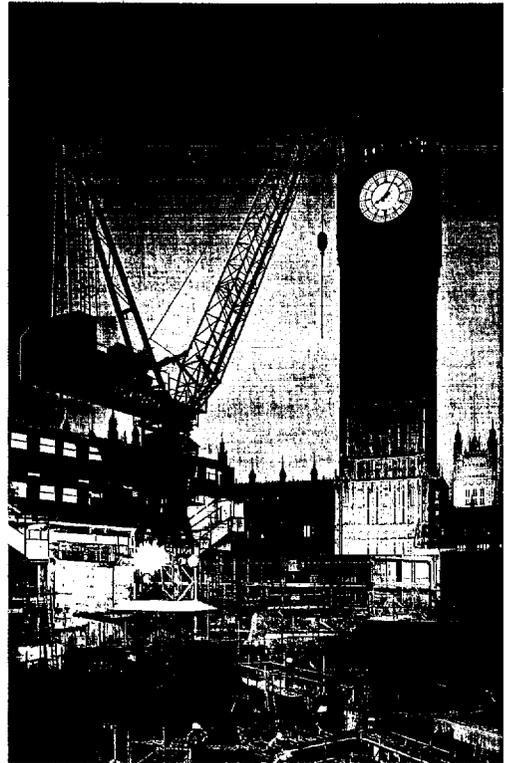
EC-H cranes in Korea



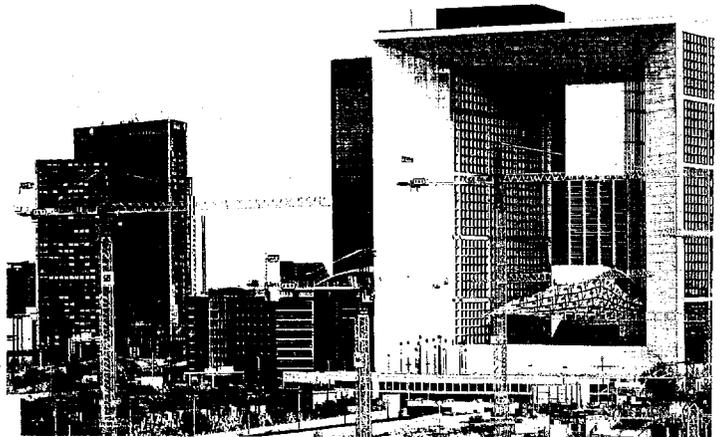
K crane in Merano, Italy



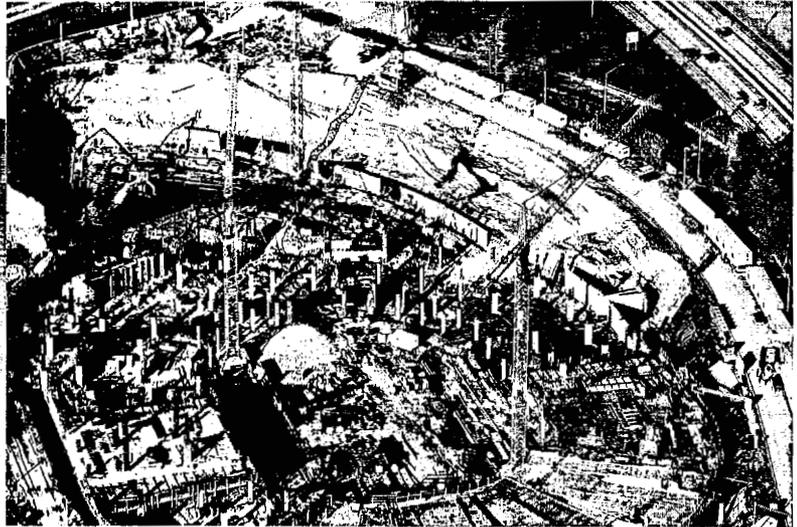
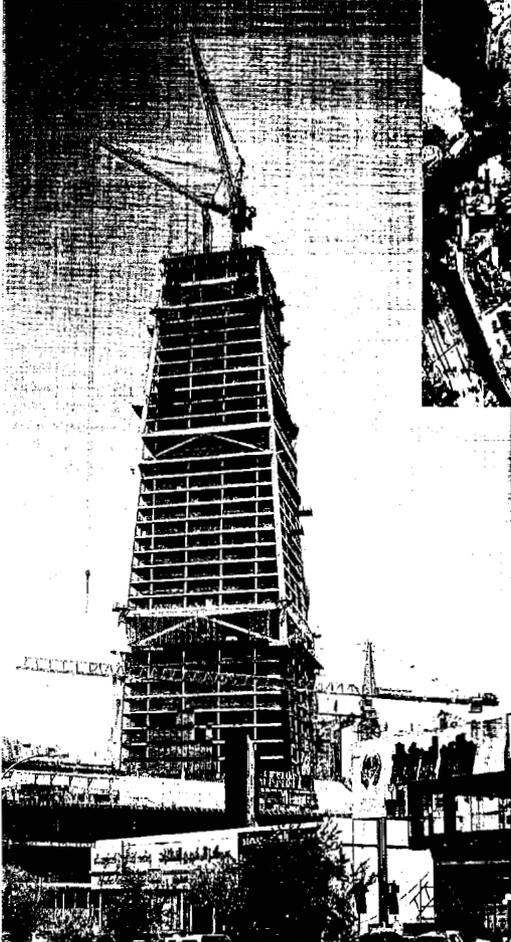
HC crane in Auckland, New Zealand



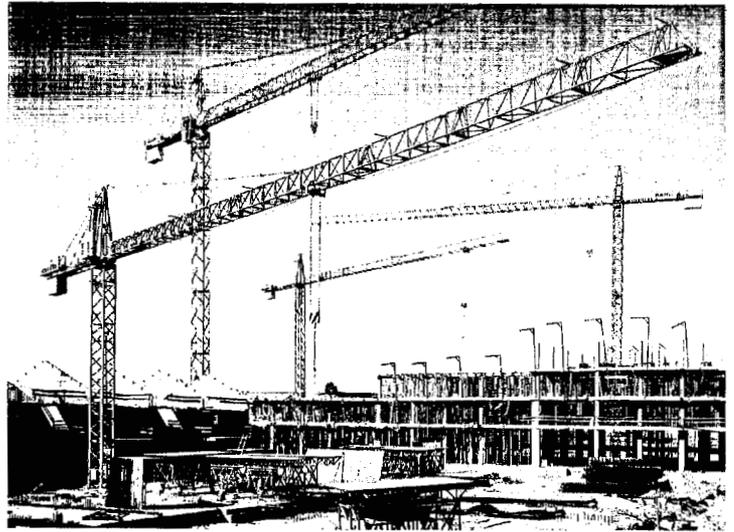
112 HC-L at Big Ben in London, England



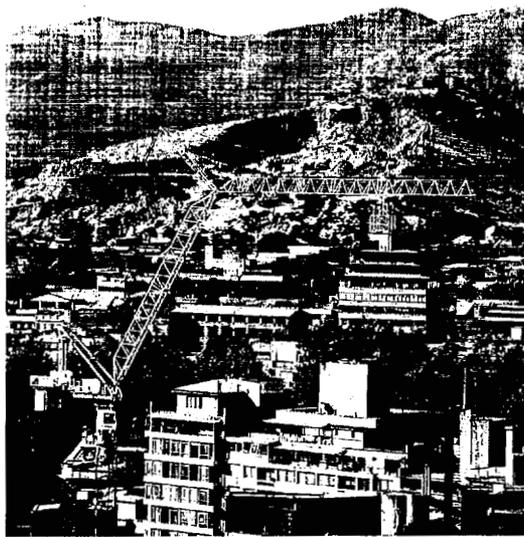
HC cranes in Portland,
Oregon (USA)



HC-L and EC-H cranes at the Al Faisalah
Center, Riyadh, Saudi Arabia

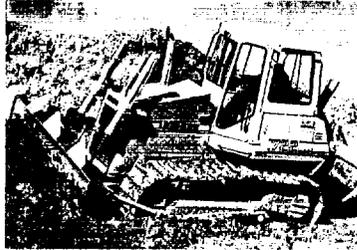


LC cranes in
Valladolid,
Spain



Liebherr drive and control components.

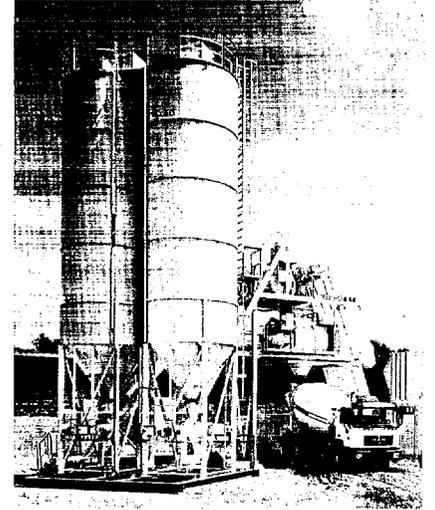
Slewing, hoist and travel gears, large ball and roller bearings, switchgear cabinets and Litronic function modules from Liebherr-Werk Biberach GmbH are also used in these machines and systems.



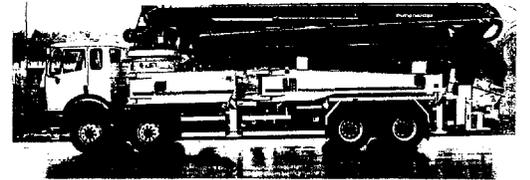
Crawler tractors and loaders

Hydraulic excavators

Wheeled loaders



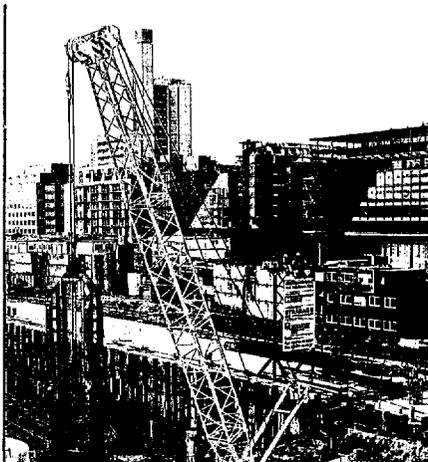
Mixing plant



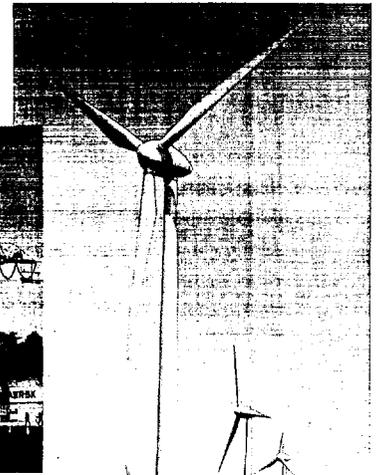
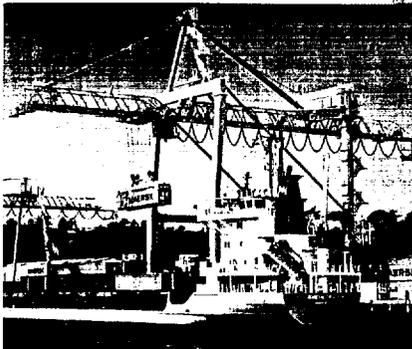
Concrete pumps

Truck cranes

Wind power plants



Hydraulic rope excavators



Ultra-modern development and design.

The construction industry requires a steady supply of new rational, economic solutions to satisfy its working processes.

Liebherr is working constantly on improvements and future-oriented solutions. Liebherr cranes determine the pace of progress with their no-compromise technologies and state-of-the-art production methods. Many different computer programs are used in the develop-

ment, trial, design and production processes.

The plants are fully linked by EDP to ensure that the flow of information is as rapid as possible.

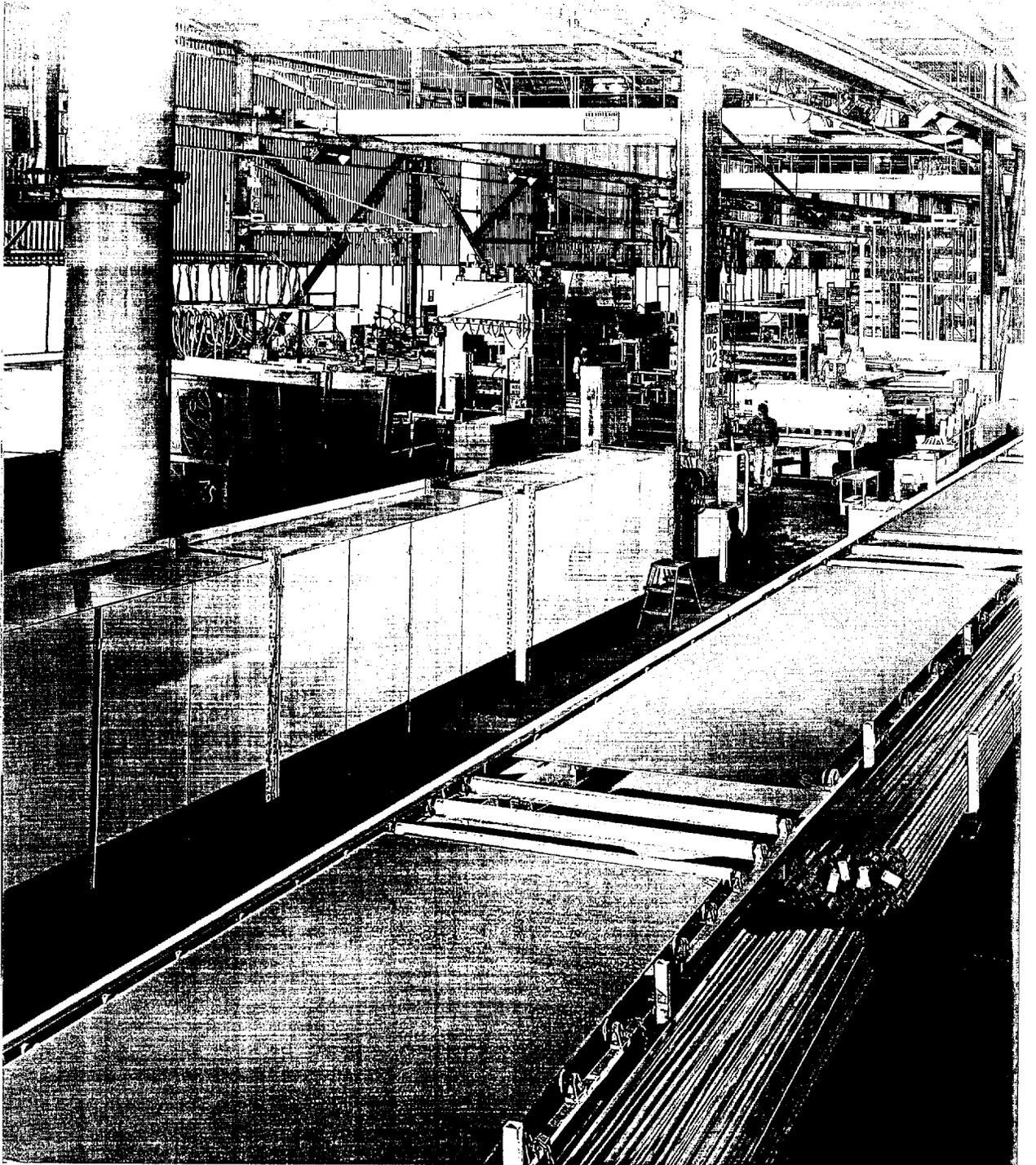


Design offices for crane construction, drive and control technologies

State-of-the-art equipment is available

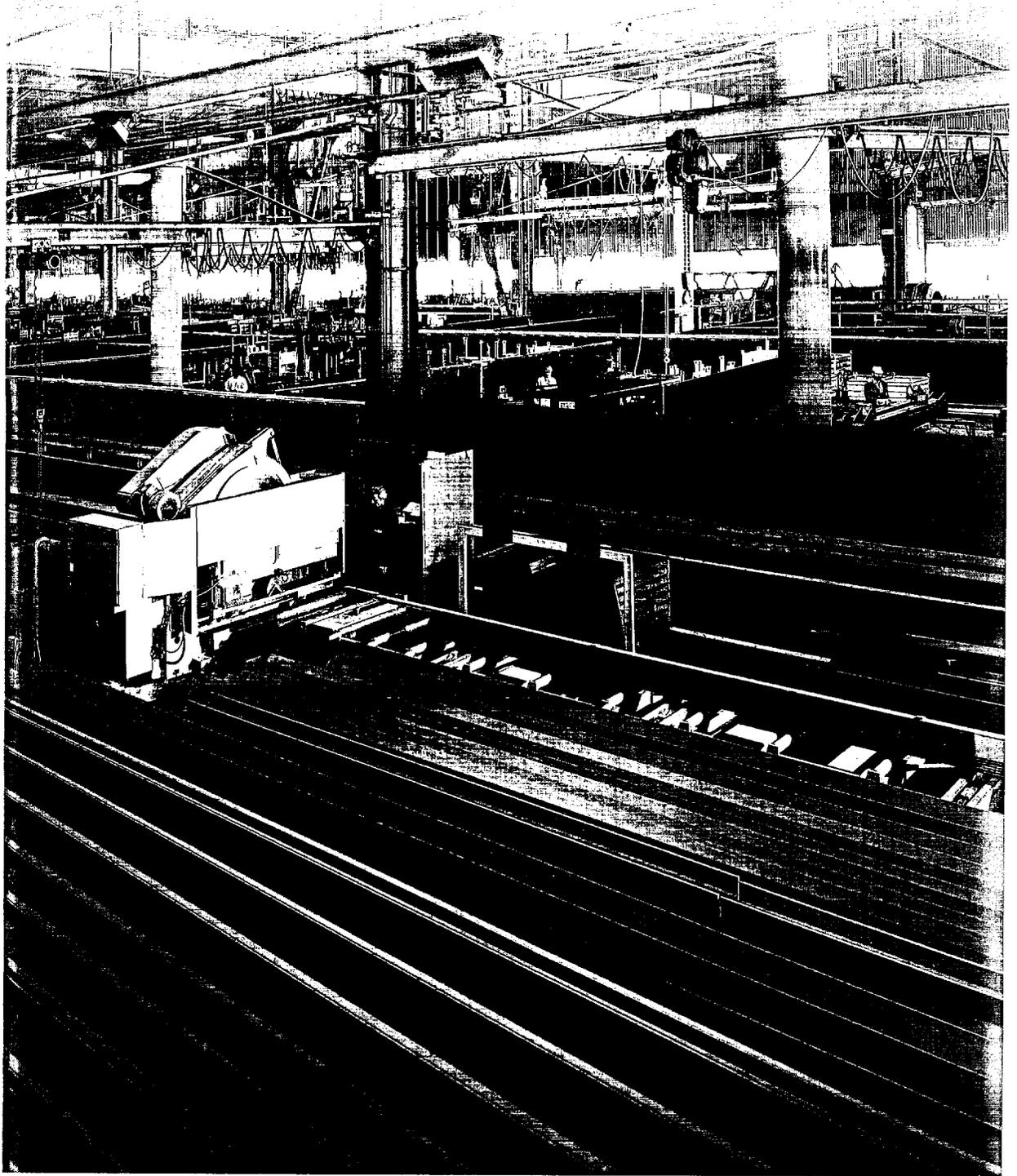


Advanced production methods: Crane construction.





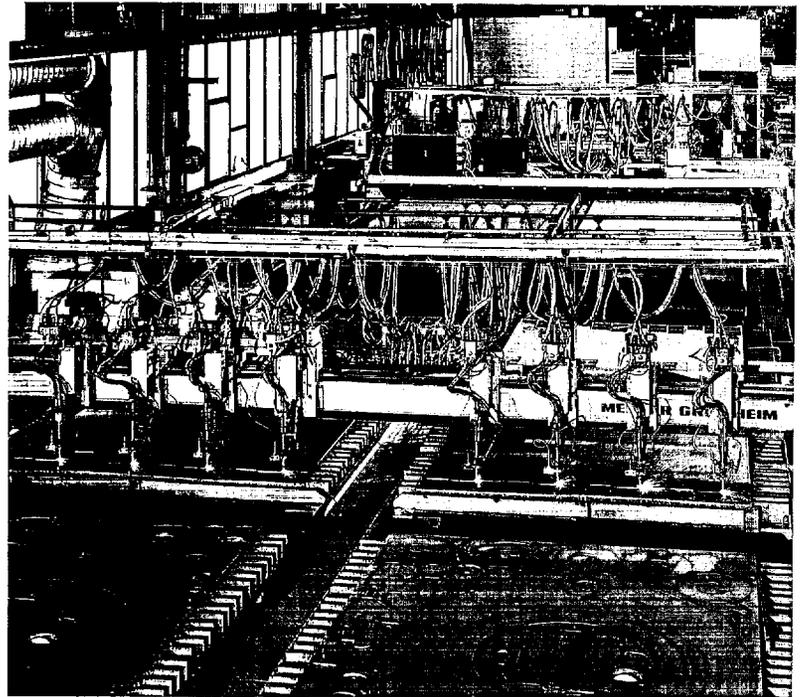
The entire crane production process takes place under ideal conditions in a production shop measuring almost 52,000 square metres



As far as cranes are concerned, steel is the most important material. Liebherr imposes severe demands on this material. It uses standardised grades of structural steel that have ideal welding qualities and are not susceptible to brittle fractures.

The steel is initially subjected to shot blasting to ensure that rust and scale are removed. Longitudinal and traverse conveyors bring the material to the cutting area for further processing.

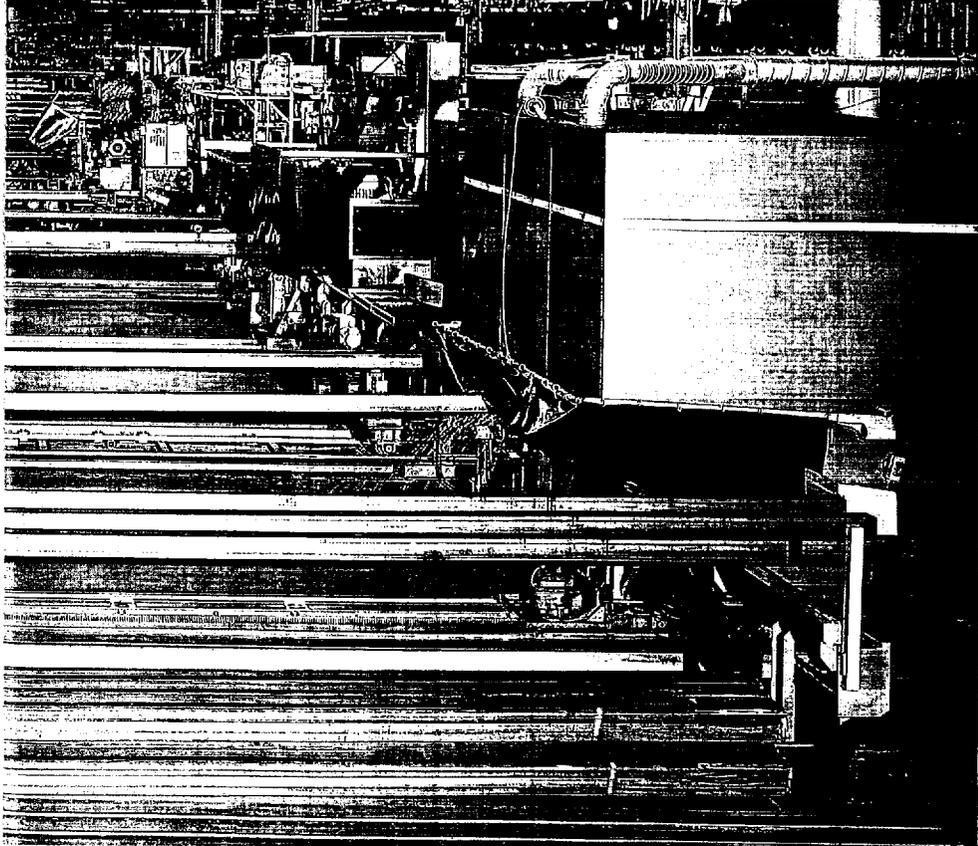
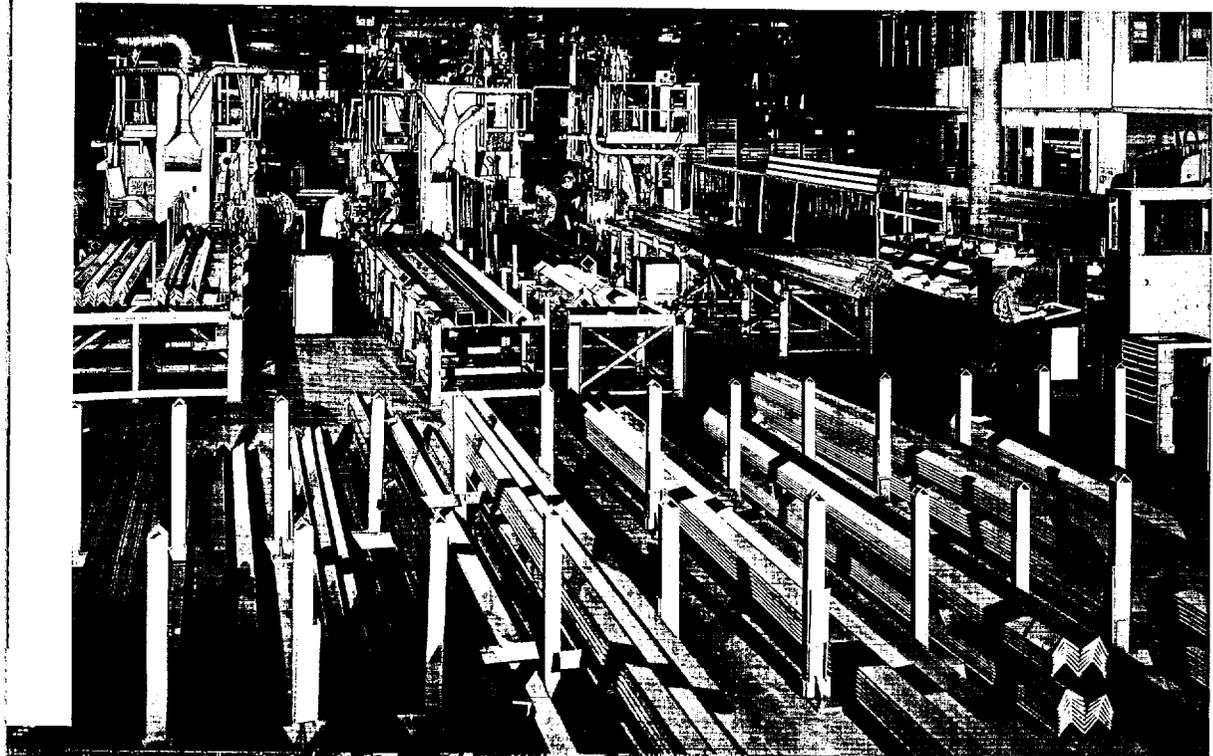
Liebherr cranes have no open angles in their structure but only enclosed, tight-welded corner posts, chords and diagonals. This reliably prevents any air from entering. The hollow-box profiles are of Liebherr's own construction. They are made by welding equal-length sides to form a box section. This production method permits larger cross-sections with more compact external dimensions to be produced.



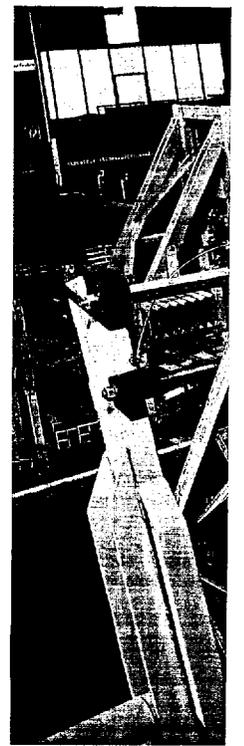
Corner-post transfer line with four welding robots

CNC portal frame cutters





**Box-section welding
line with five welding
machines**

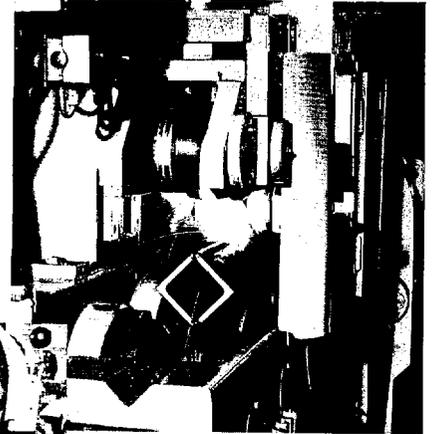


This is of major importance when building tower cranes, because their stability is mainly determined by the area exposed to wind loads. The reduced external dimensions resulting from Liebherr's method help to reduce the wind forces acting on its cranes.

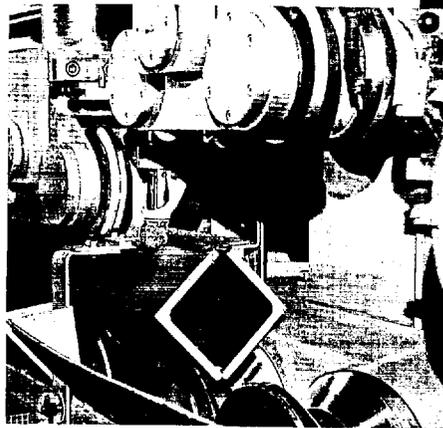
The welded structures are manufactured by the latest mechanised methods, including metal-arc gas-shielded and submerged-arc welding.

All the corner posts for tower sections between 2.4 and 12.5 metres in length are made in one piece on a 45-metre long transfer line.

All work processes such as tight welding of the box sections, welding of the forged connectors by robots, milling of the ends, drilling of the connecting holes, notch grinding of the overlap weld seams and quality tests are carried out simultaneously at both ends of the corner posts.



Metal-arc gas-shielded welding



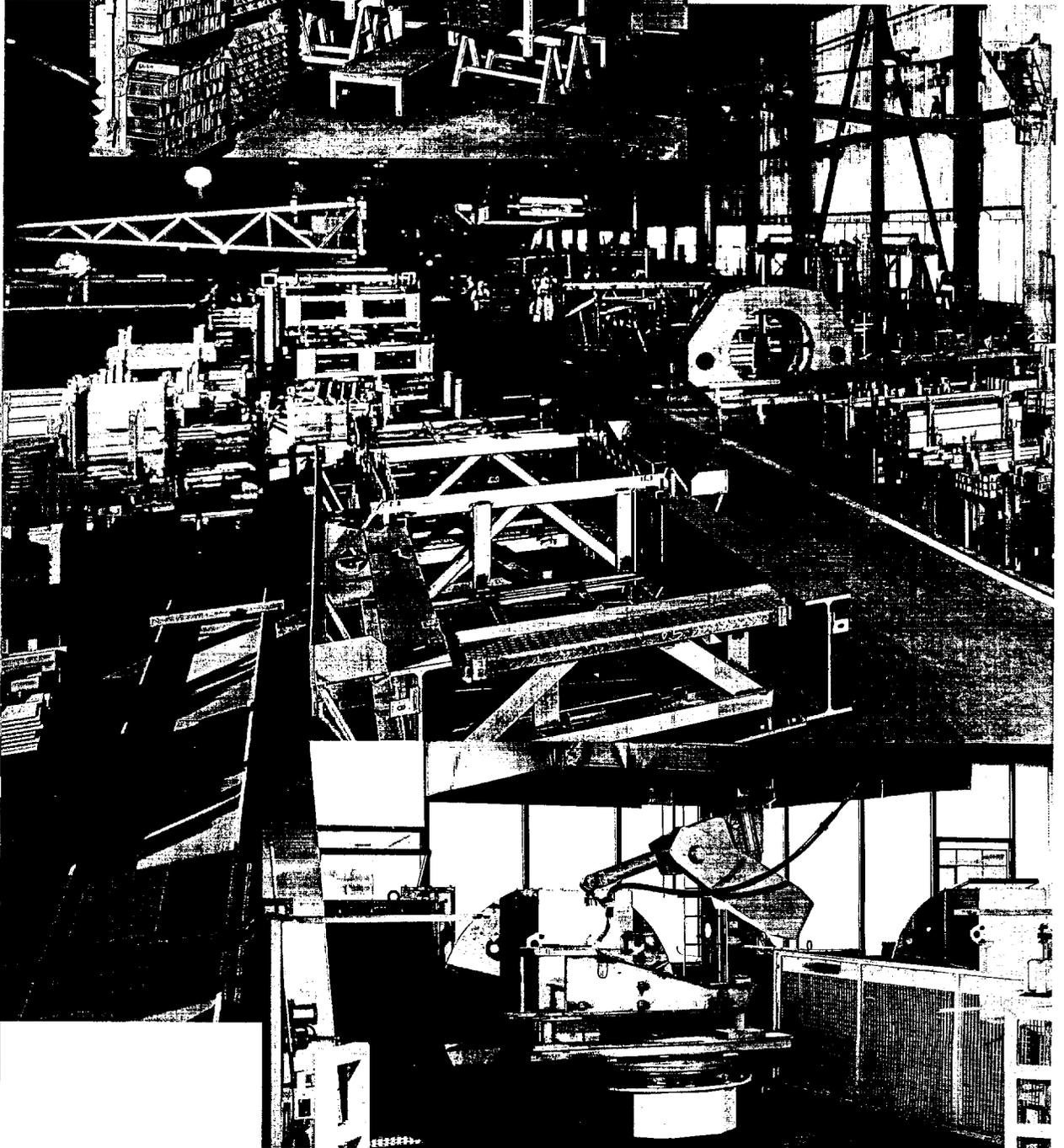
Submerged-arc welding

Welding of tower sections in rotating fixtures





Preparing weld seams on the diagonals



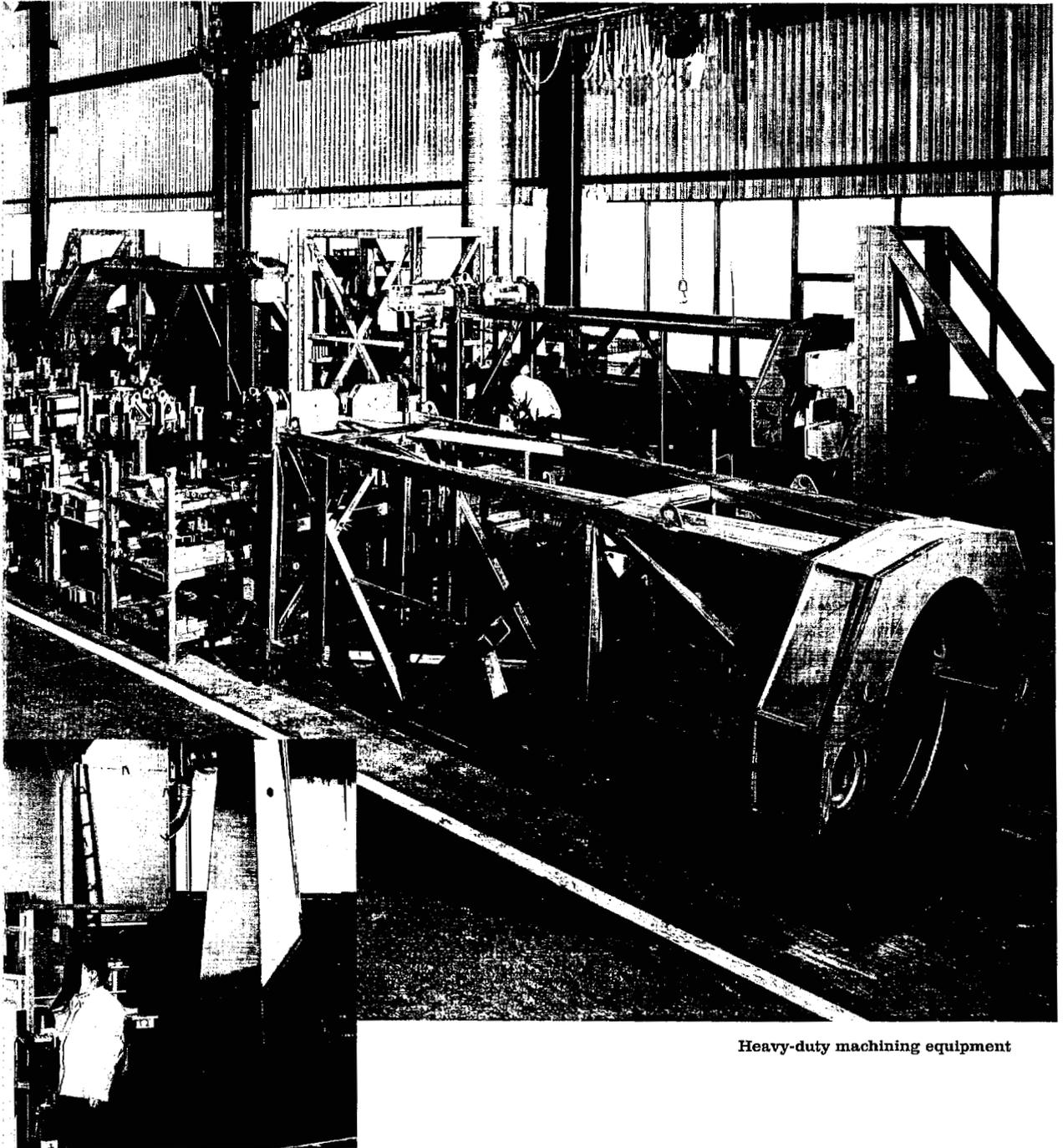
The special method of corner-post manufacture assures high assembly accuracy and a large contact area. This transmits loads efficiently and makes Liebherr cranes extremely stable.

Corner posts and diagonal struts are assembled in production fixtures to form the complete

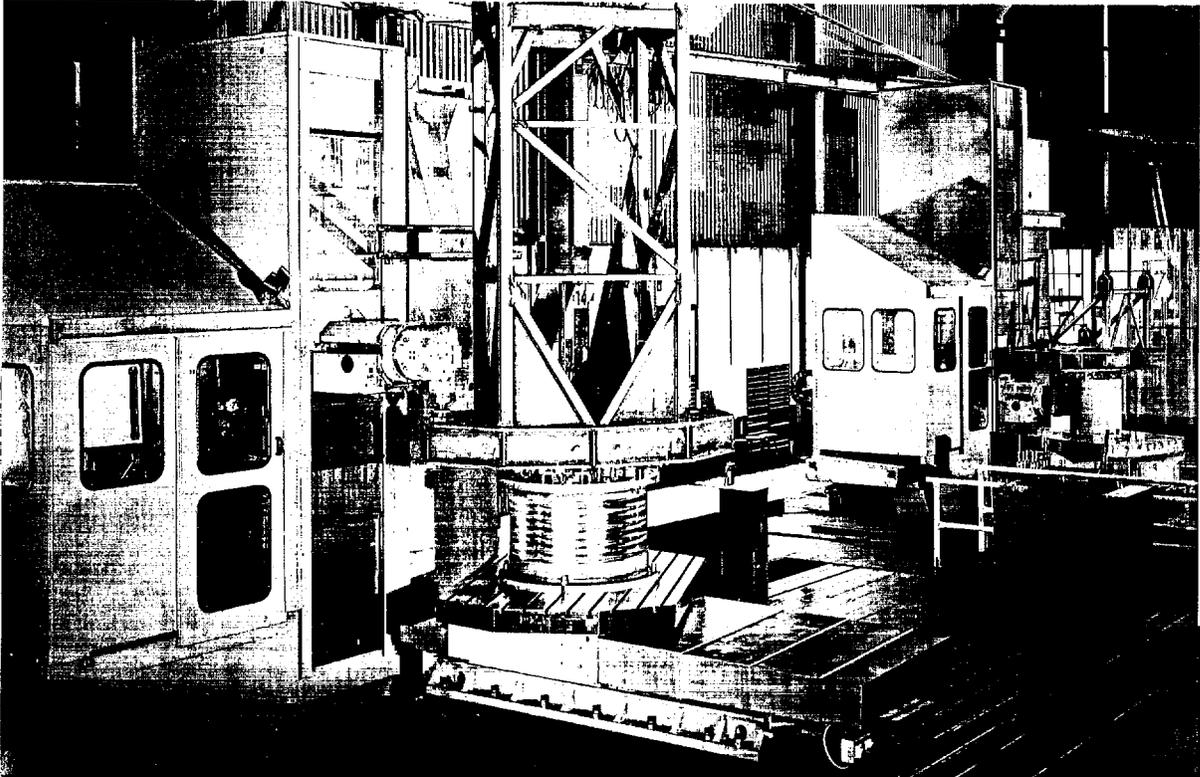
tower. This too helps to ensure that the tower sections are within the permitted tolerances.

Great emphasis is placed on thorough preparation of the welded seams, so that the resulting welded joints are extremely strong and capable of withstanding extreme loads.

All machine cutting takes place in the heavy-duty machinery section. It is here that the jibs, tower heads, tower sections for large cranes, slewing ring supports, slewing platforms and climbing equipment are manufactured, using the latest numerically controlled drilling equip-

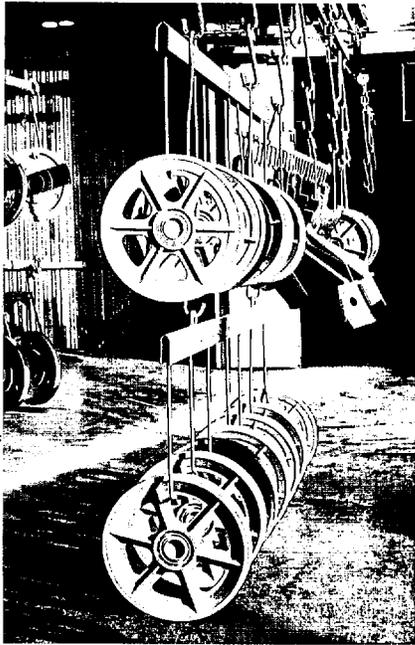


Heavy-duty machining equipment



**General drilling and
milling machines**





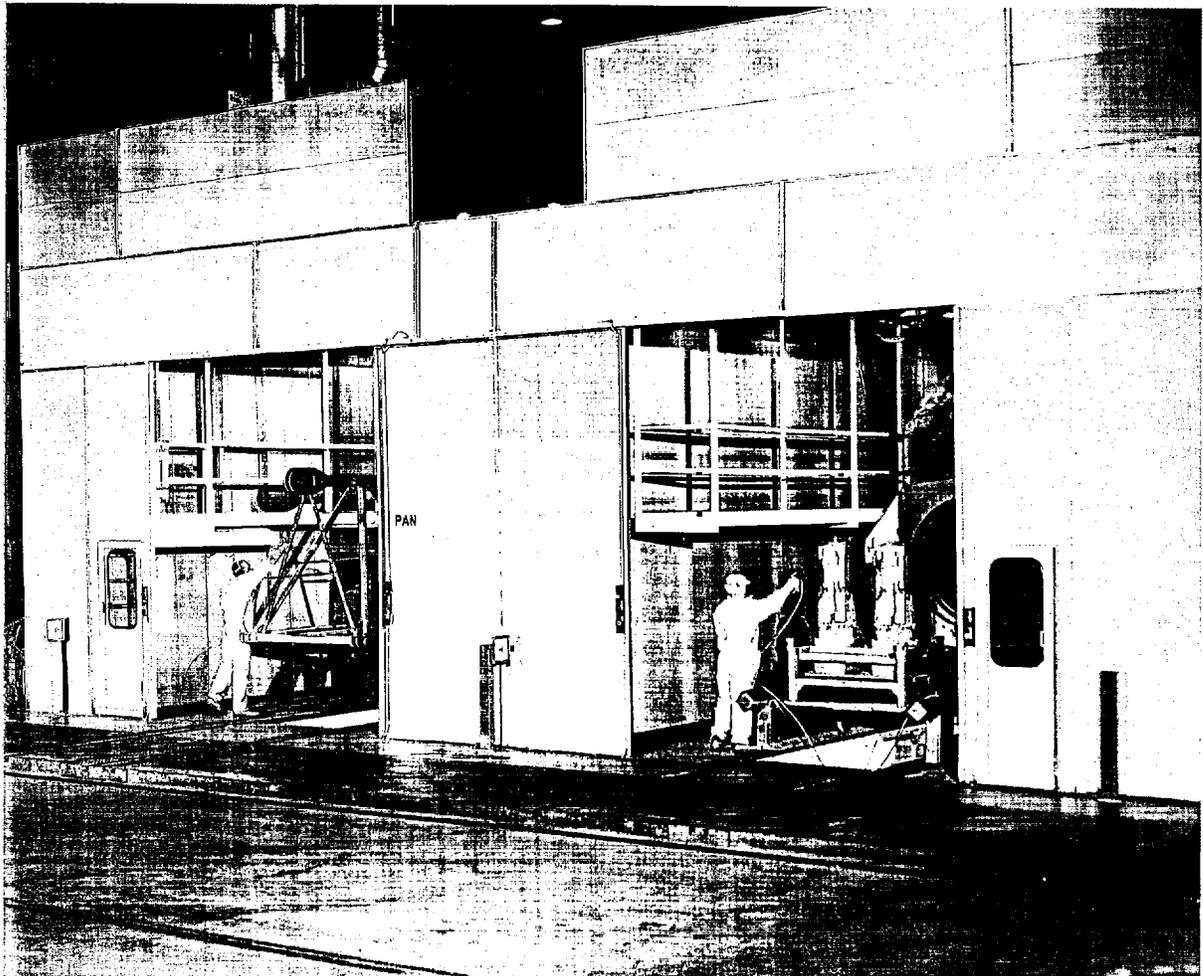
ment, welding robots and general welding and rotary handling equipment.

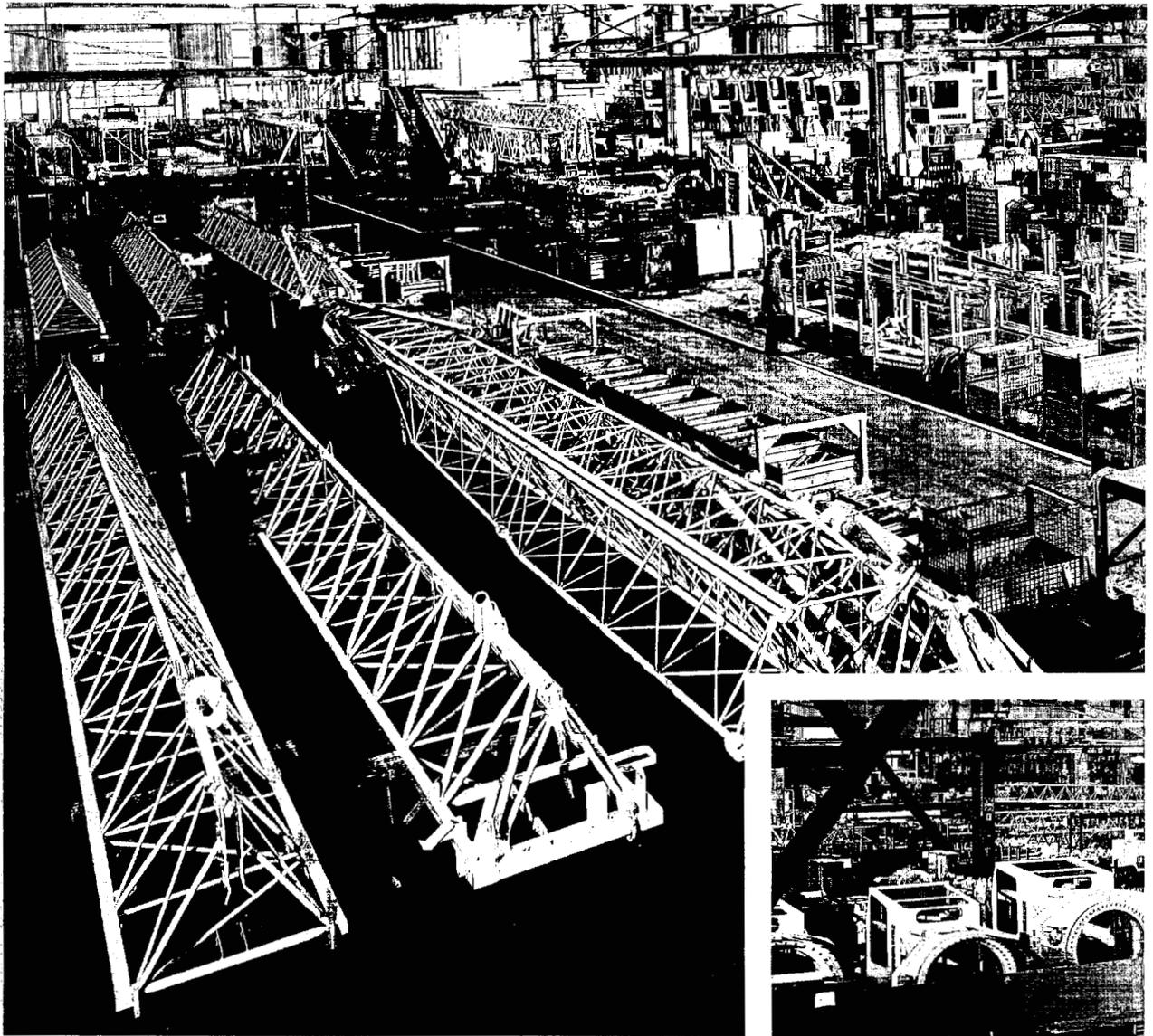
These heavy-duty machines and equipment permit efficient machining of large workpieces to the highest degree of precision, with low assembly tolerances.

The paint finish consists of a primer and a top coat. The dry coat layer has a thickness of at least 50 μ .

Large parts are painted by the airless spray method; smaller items pass through an electrostatic hot airless spray process. After this, parts are oven-dried at 80° Celsius.

Paint shop for small parts





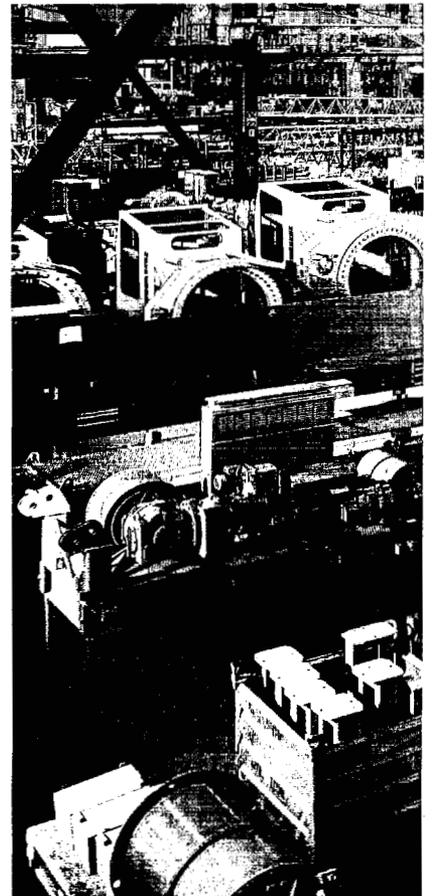
Final assembly takes place on a single line for the fast-erecting cranes and two for top-slewing cranes. Located in between are the component lines for the finished drives, for example slewing, travel and hoist gears and the control-system elements.

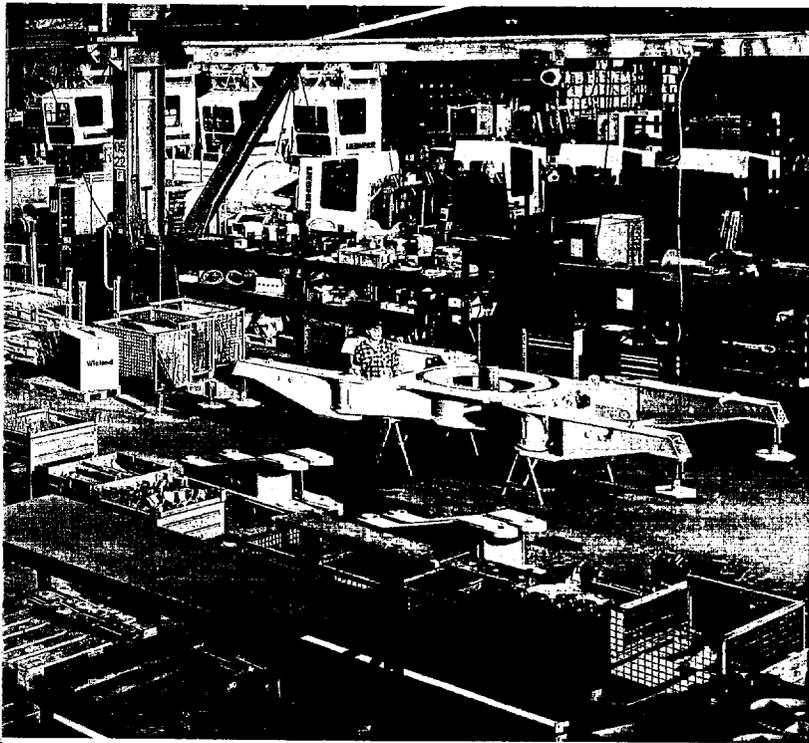
In the final assembly area the pre-assembled and painted sub-assemblies are joined together and fitted with slewing platforms and winches. Each work station is equipped with its own assembly crane.

Final inspection is carried out by a team of highly qualified, responsible personnel.

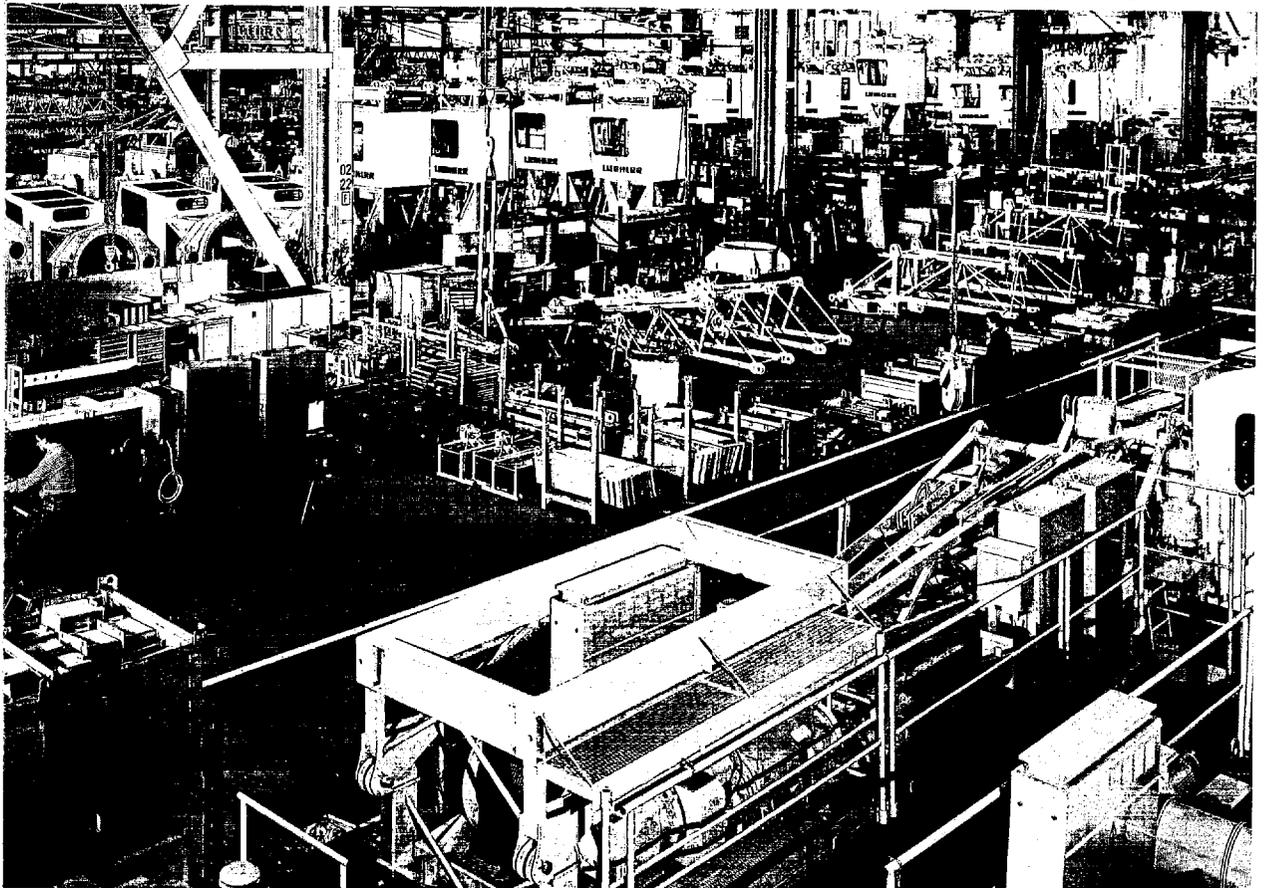
At the end of the assembly shop fast-erecting cranes are loaded on to high-speed axles or flatbed trailers for final delivery in their assembled state. Depending on their size, top-slewing crane components are delivered in the correct assembly sequence or loaded into containers if the journey is longer.

In all stages of Liebherr tower crane production, the latest technological methods ensure that work takes place in an environmentally compatible manner.



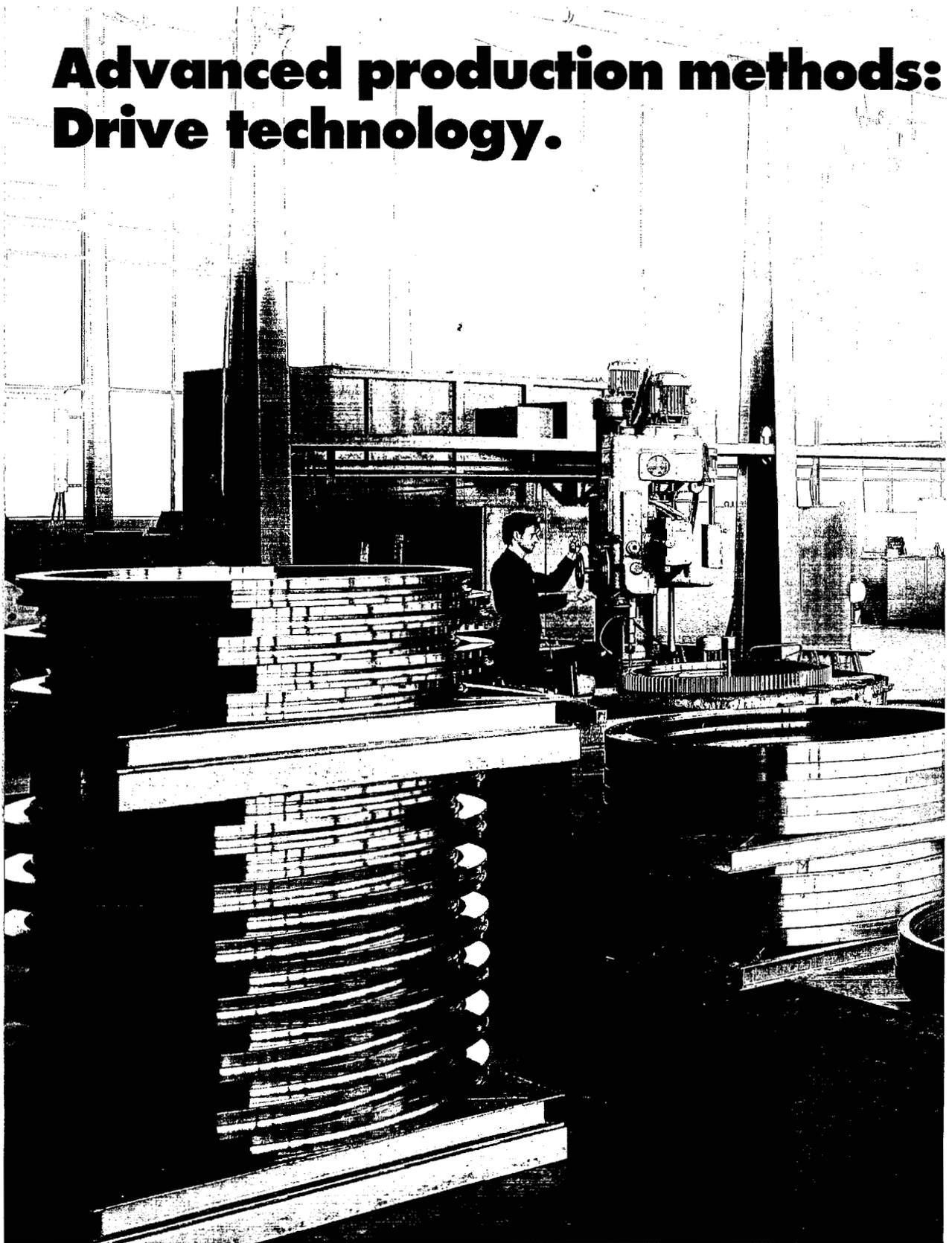


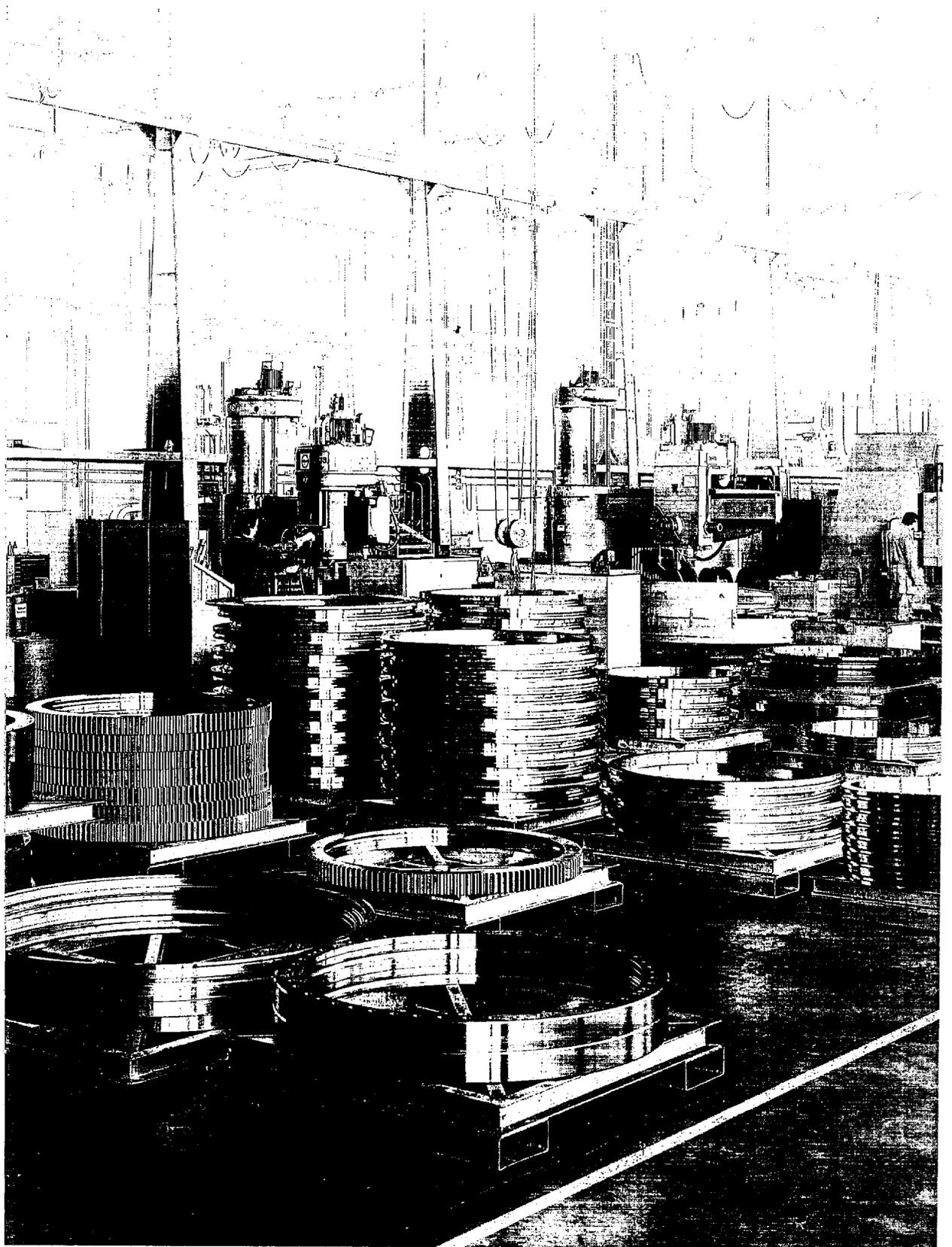
In the foreground the final assembly area for fast-erecting cranes



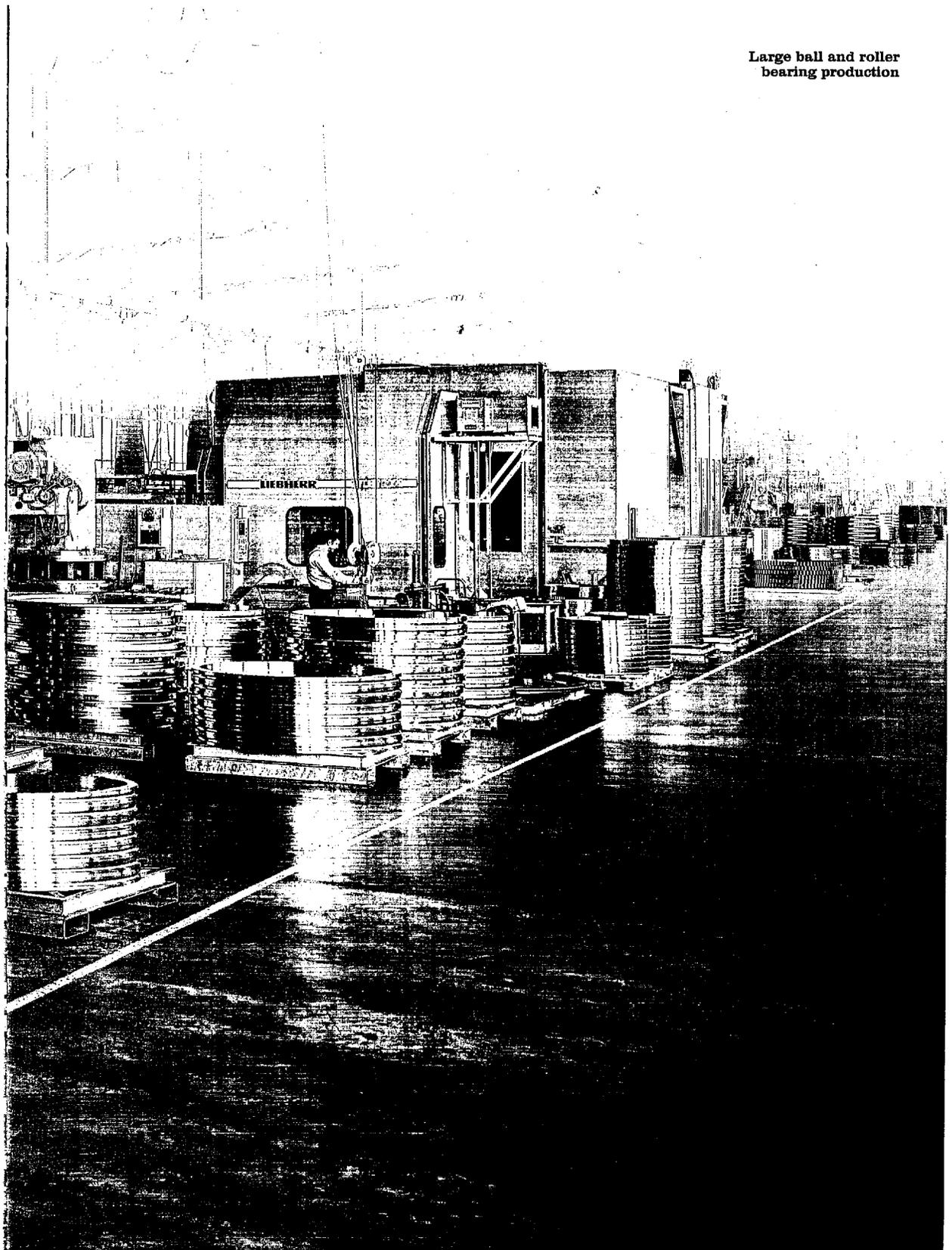
The final assembly lines for top-slewing cranes

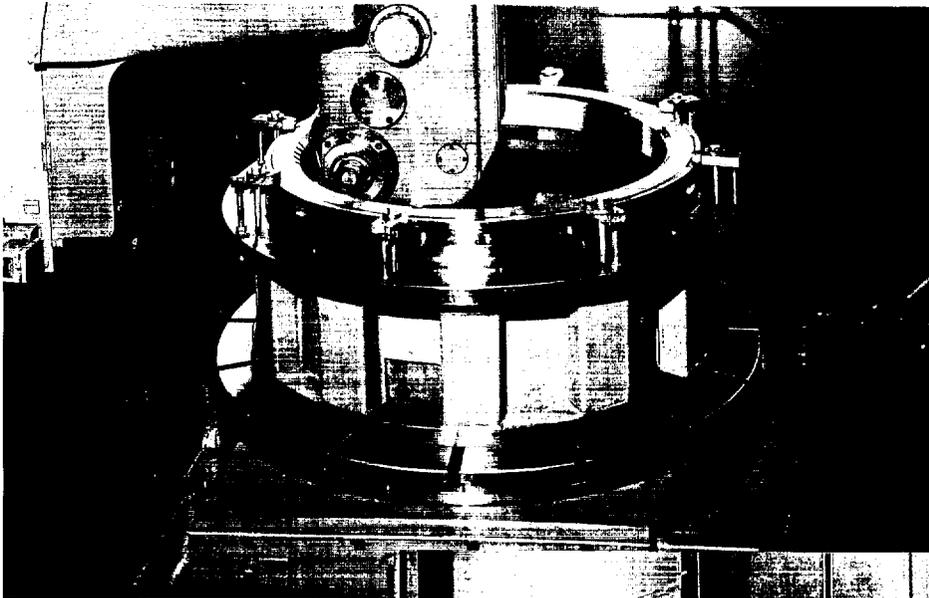
Advanced production methods: Drive technology.



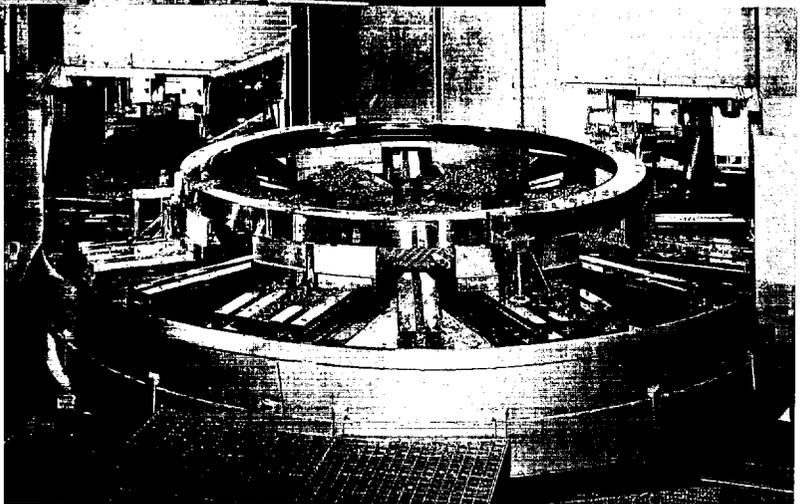


Large ball and roller bearing production





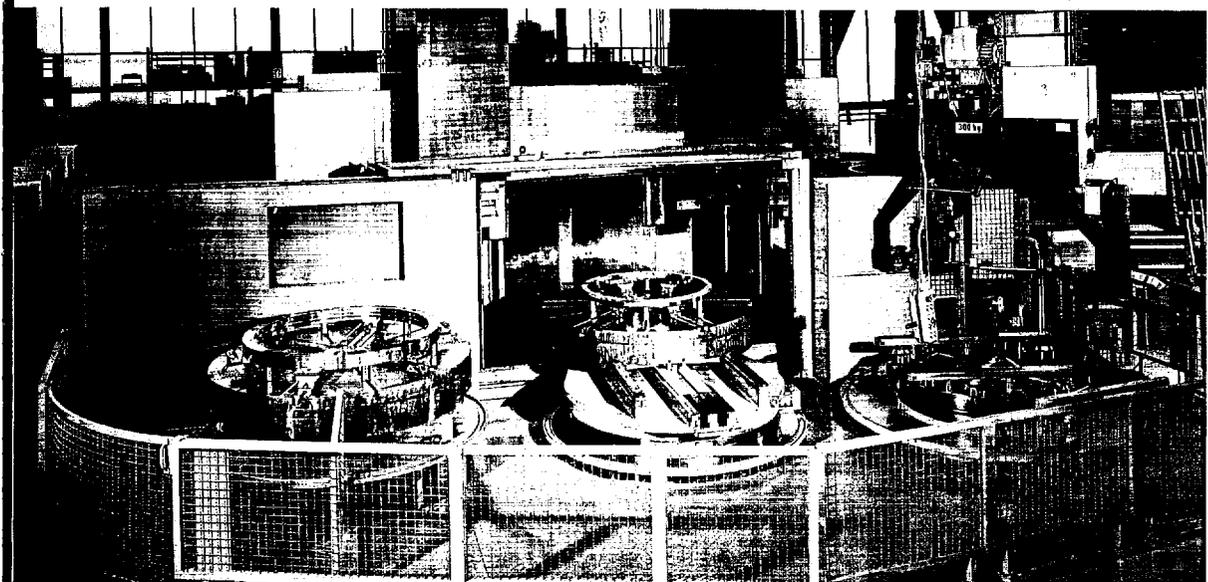
Single-tooth milling machine, fully encapsulated



Drilling machine

Liebherr-Werk Hiberach GmbH possesses more than 40 years of experience in the design, manufacture and use of large ball and roller bearings. Well over 100,000 construction machines - tower cranes, hydraulic and rope excavators, truck and mobile cranes, harbour and ship's cranes and concrete pumps as well as wind-power facilities and other special-purpose units - have already been equipped with large ball and roller bearings of Liebherr's own manufacture.

Turntable slewing machine for face-turning and drilling

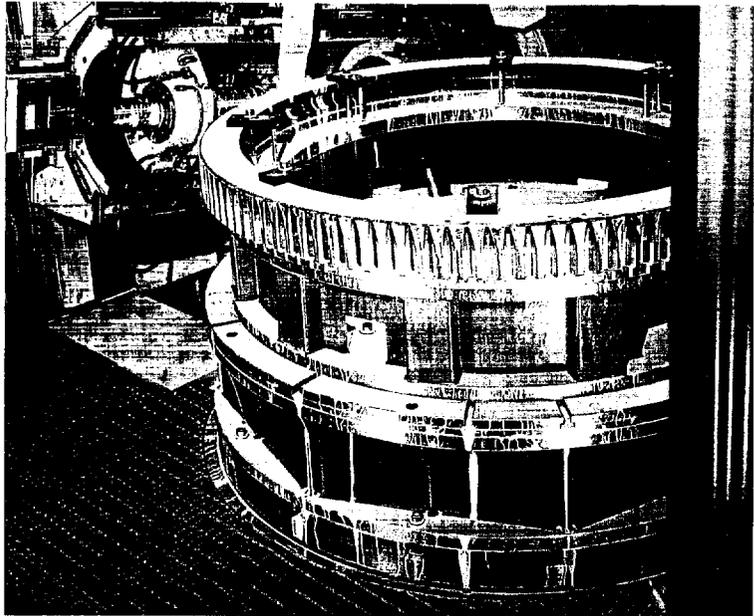


At the moment, more than 6,000 ball and roller bearings are produced annually for the Liebherr Group's needs alone.

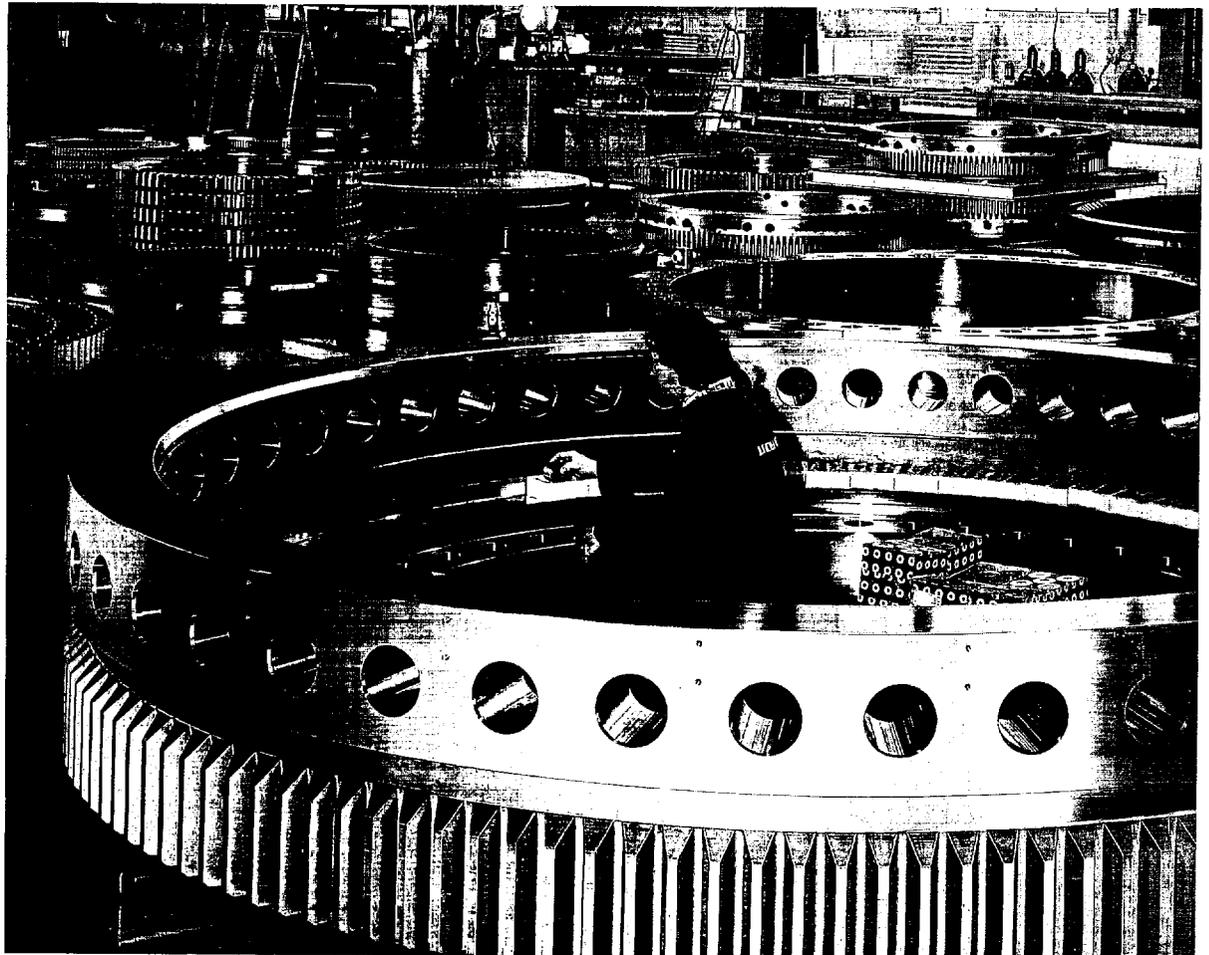
The production programme extends from 600 mm to 4,500 mm in diameter, with unit weights up to 15,000 kg. This extensive range of dimensions and patterns can be adapted on request to produce special sizes and designs. The very latest quality assurance tests are applied.

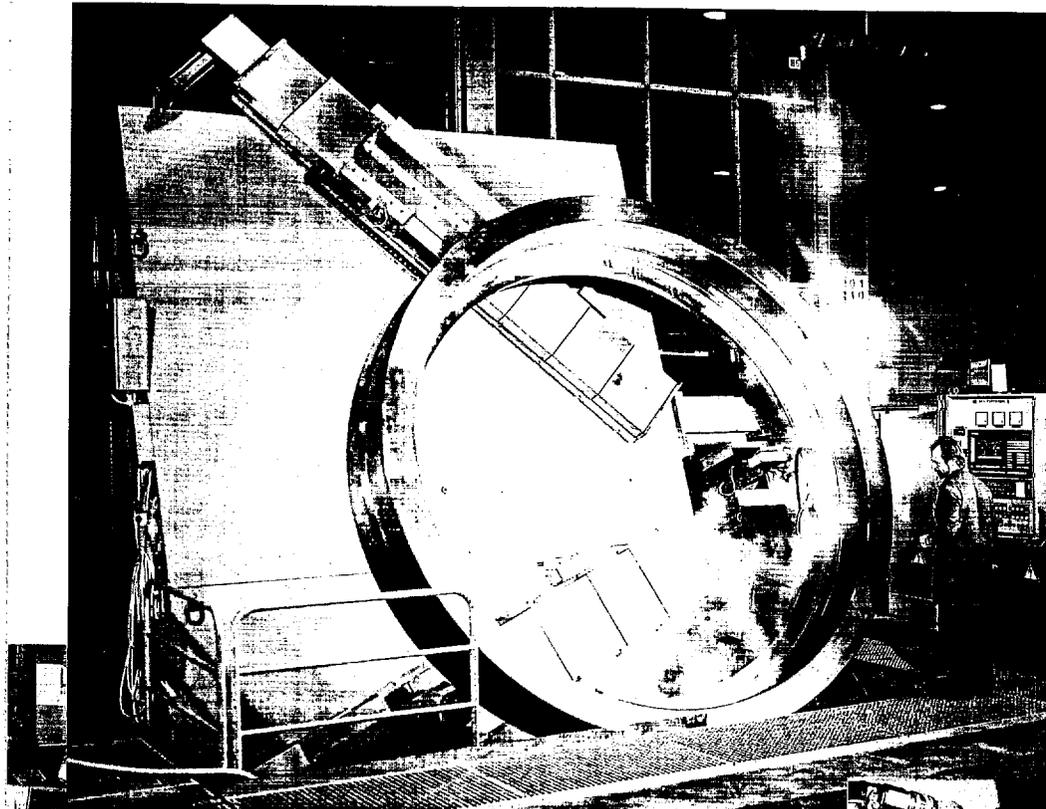
Modern vertical lathe-turning machines are used to produce the individual special-section rings for the large ball and roller bearings. Most machines are equipped with a workpiece measuring unit with error correction capability. This serves to guarantee exceptional machining accuracy.

Gear-tooth forming on a hob-milling machine



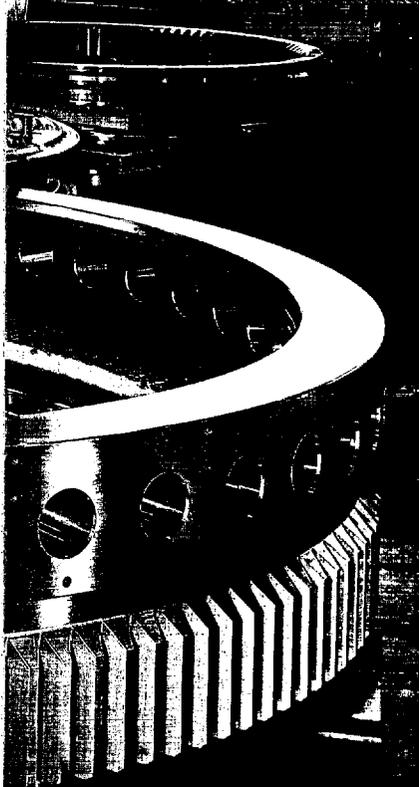
Final assembly of large ball and roller bearings





CNC
induction-
hardening
machine for
roller and ball
tracks

Process
sensor
monitoring of
hardening
temperature



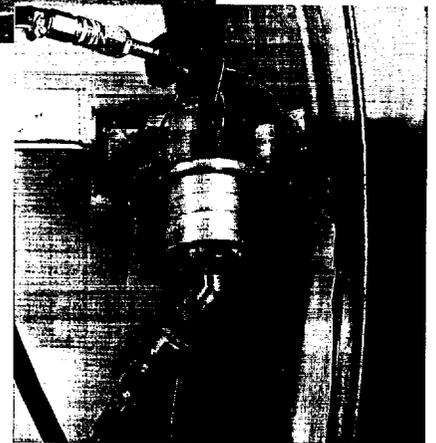
In all cases, seamless rolled blanks of high-alloy chrome-molybdenum steel, conforming to Liebherr's own internal specifications, are processed.

Machining accuracy, in particular for the ball and roller track contact surfaces, is in the micrometre range. CNC-controlled drills with automatic tool changing enable the mounting holes to be drilled in any required pattern.

The ball and roller tracks are induction-hardened by a recirculation process. The use of integrated sensors during the hardening process ensures high quality.

State-of-the-art gear-shaping machines, themselves developed and built by the Liebherr Group, can mill external or internal gear teeth up to module 25. External gear teeth are normally hobbled, internal teeth fly-milled.

Single-row slewing rings take the form of four-point ball bearing assemblies. This pattern is suitable for small to moderate loads and has proved highly successful in many application areas.

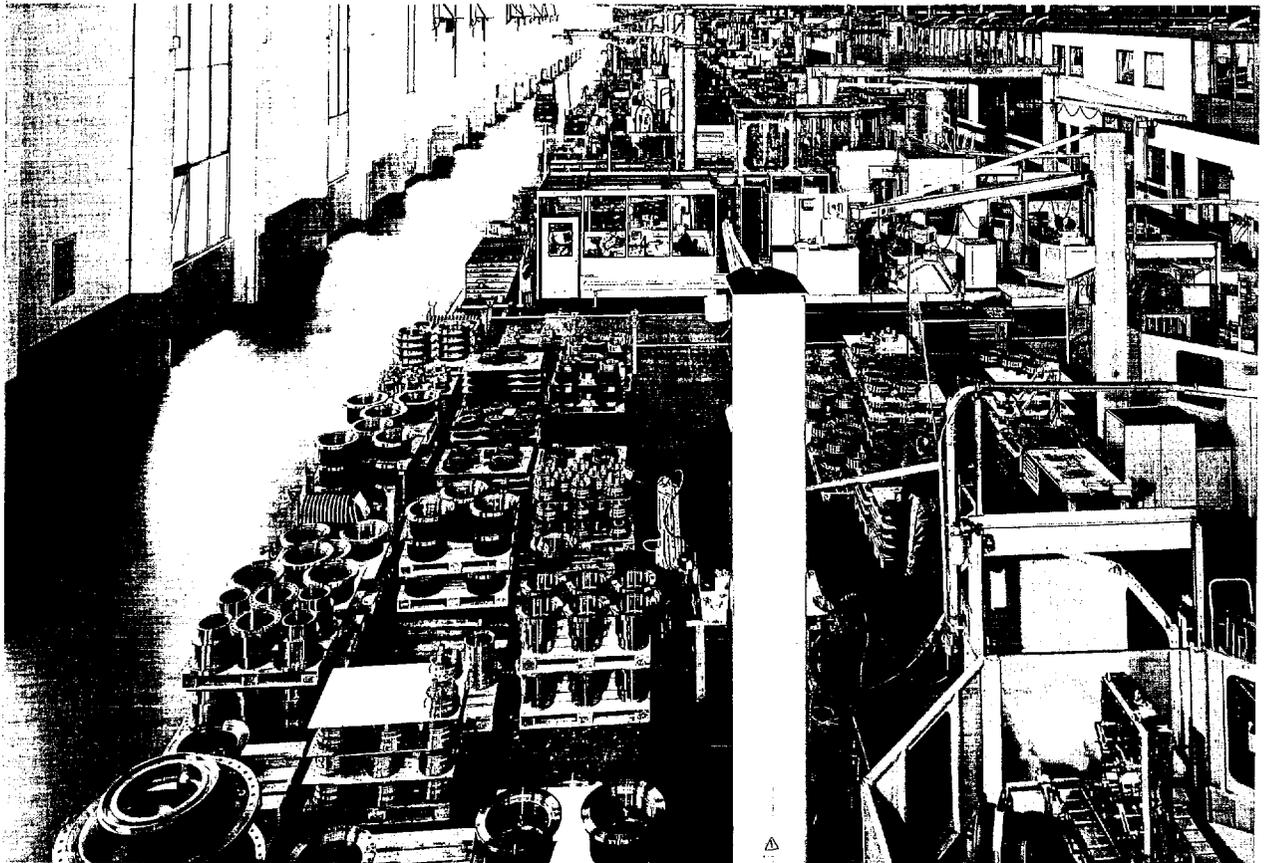


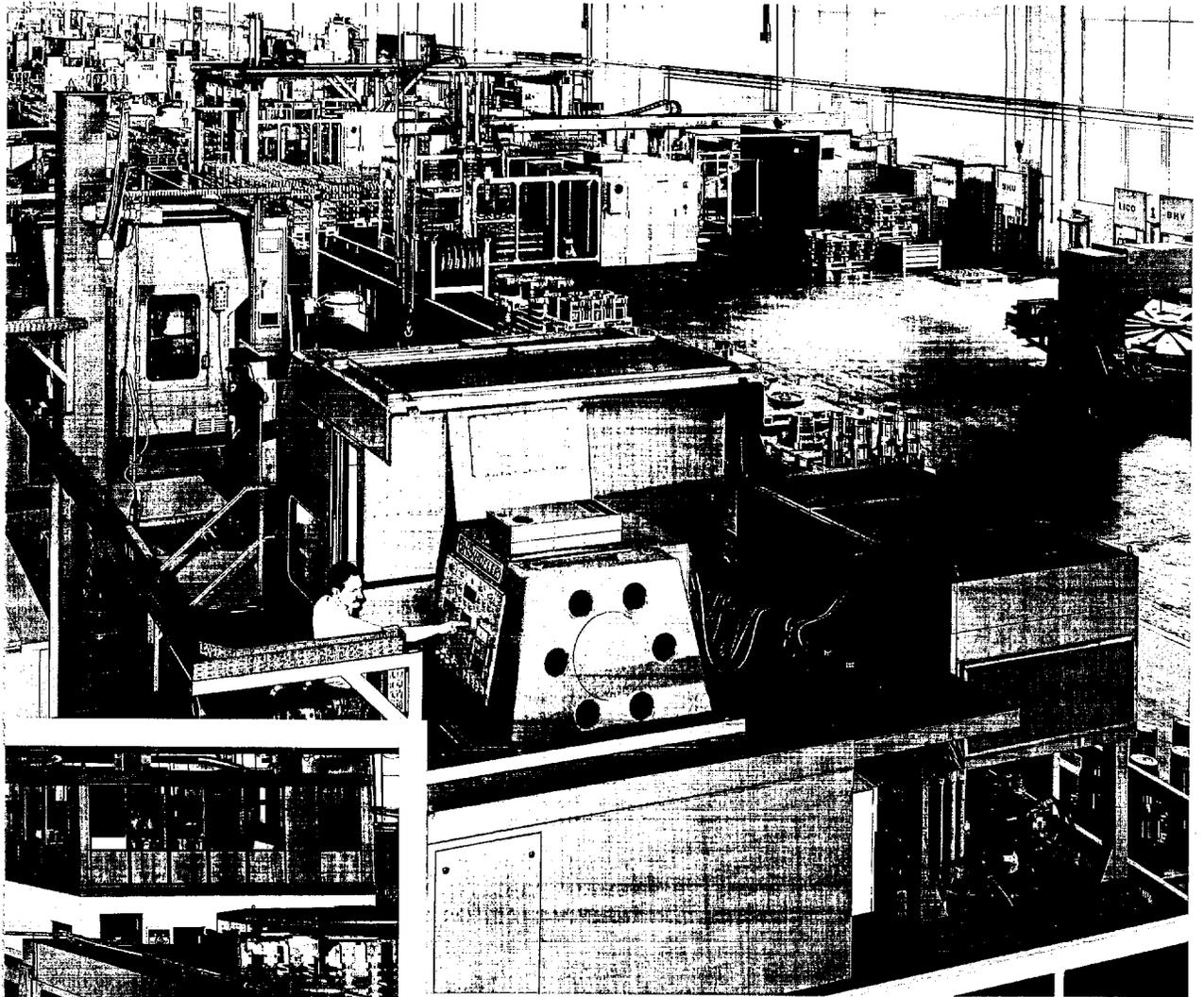
For considerably higher load capacities, three-row roller slewing rings are available. In sizes up to 4,500 mm, this pattern is chosen when loads are severe and stringent operating-life and reliability requirements are imposed. Liebherr's large ball and roller bearings have ingeniously designed seals and are therefore secure against water and dirt penetration.

Right-hand side of hall:
gear-forming area



Left-hand side of hall:
turning, milling and
drilling





Mechanical production.

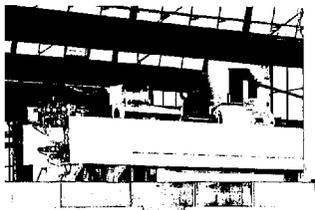
Slewing or pivoting gears, hoist and travel gears are developed, designed and built for tower cranes, hydraulic excavators, hydraulic rope excavators, crawler tractors and loaders, wheeled loaders, mobile and truck-mounted cranes, crawler cranes, ship's cranes, container cranes and freight-handling cranes as well as concrete pumps and wind-power facilities. With the exception of castings and connecting materials, all components are made within the Liebherr Group.

Liebherr drive systems possess specific features such as the use of hardened and precisely ground gear wheels in all cases. They have extremely low friction characteristics and controlled, uniform meshing of

improve smoothness, ensure a high degree of efficiency and reduce noise.

To produce these drive trains the plant is equipped with state-of-the-art machines, including drilling and milling centres, lathes with up to six controlled axes, induction-hardening equipment and automated gear-forming machines.

Corrosion proofing takes place in a washing and conservation system as well as by dip coating and painting.



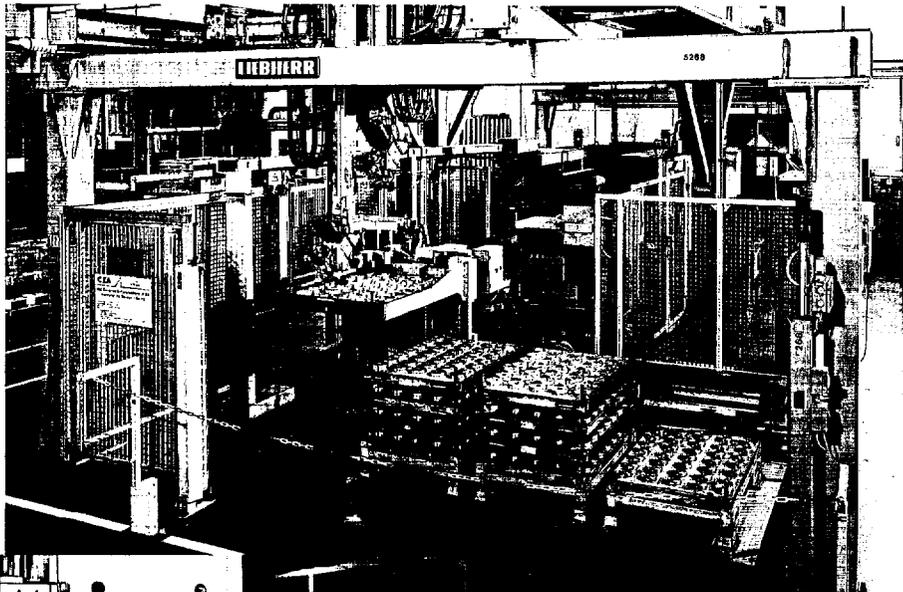
Vertical CNC lathe-
turning centre with
three axes and 20 tool
stations

In the washing and conserva-
tion system residual contamina-
tion from the production process
is removed from the parts.

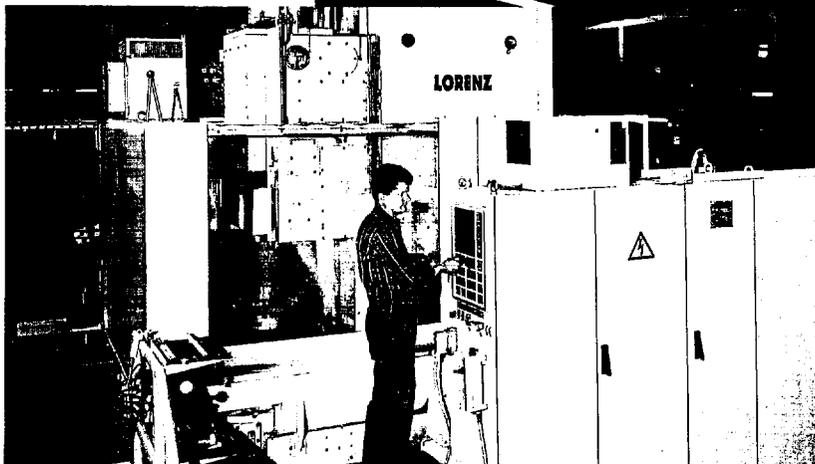
In the dip coating and painting
system the finished or semi-
assembled parts are coated or
passed through an airless spray-
ing process.

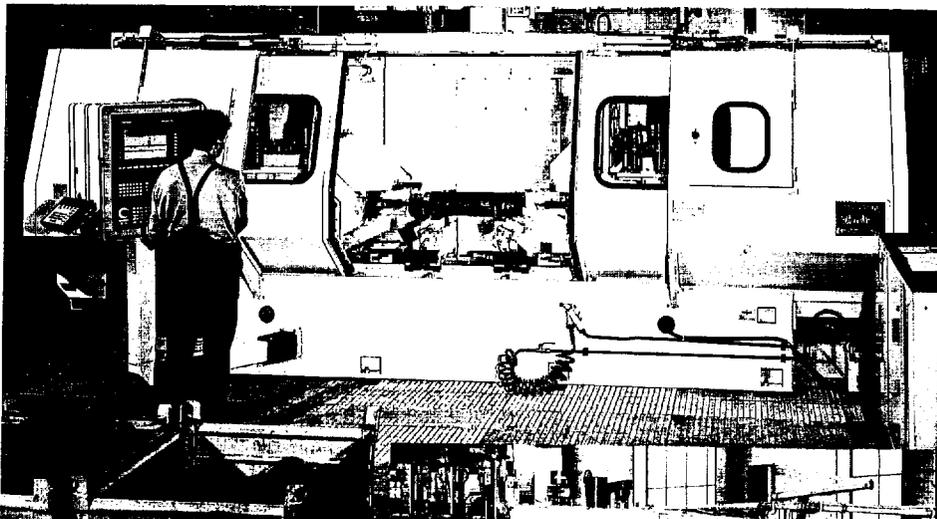
A state-of-the-art vacuum
distillation plant enables the
coolant from the turning, milling
and shaping machines to be re-
cycled and used again. This sub-
stantially reduces the volume of
coolant required as well as the
amount of waste.

These production techniques
are of the highest standard and
ensure that Liebherr drive train
parts are of optimum quality.

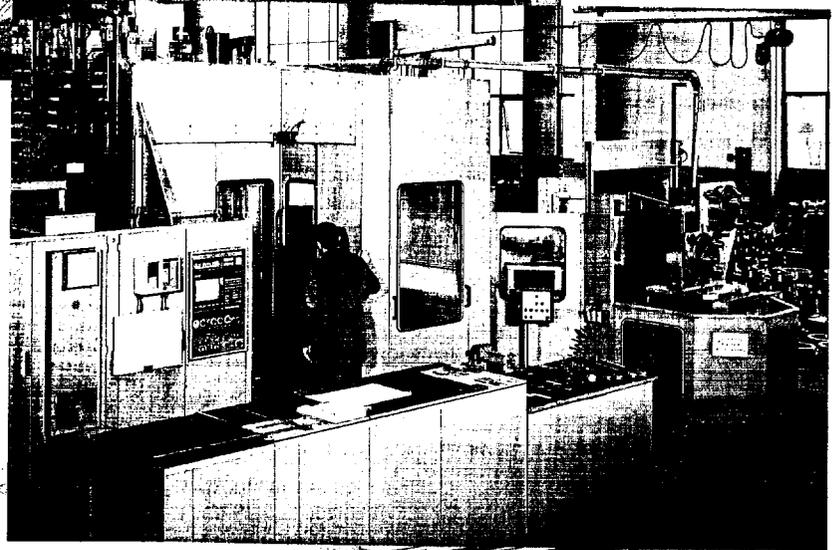


CNC twin spindle
automated lathes with
automatic workpiece
measuring systems





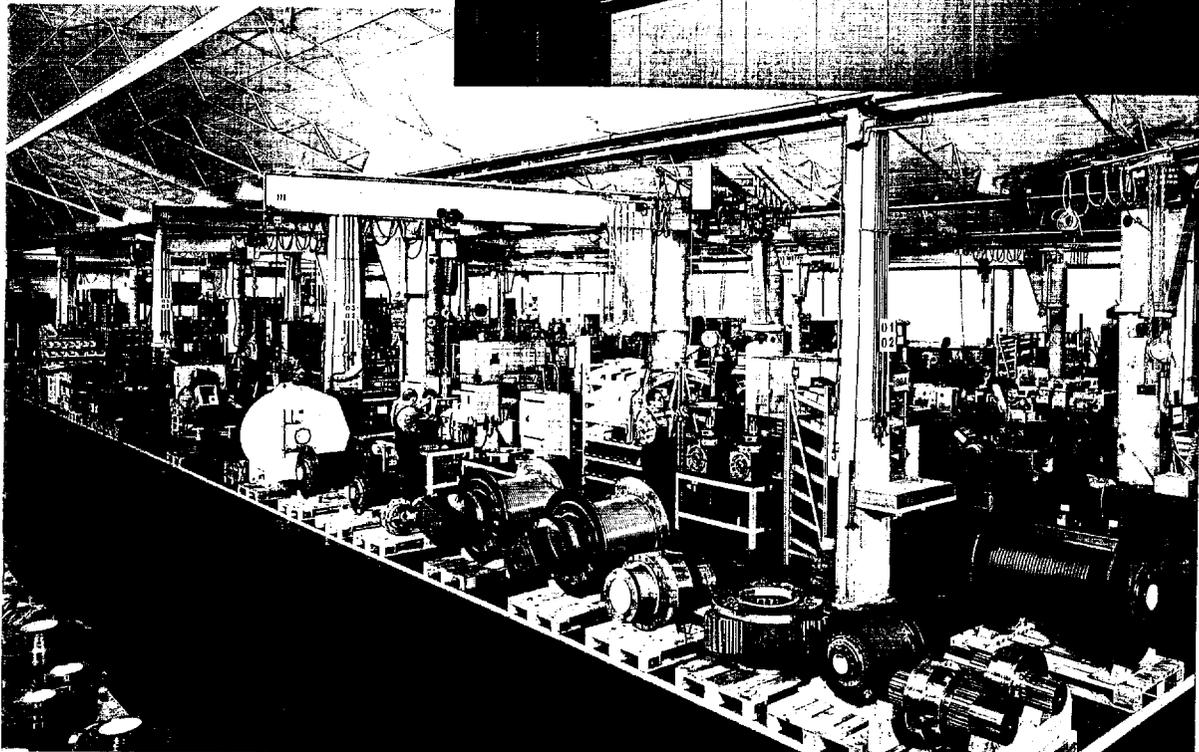
Drilling and milling machine with 2 tool trays and 18 tools



CNC machining centre with 4 axes and 173 tool stations

The drive train components then pass to the transmission assembly area. Drive train weights can vary between 75 and 8,000 kg. Every drive train is subjected to a leakage inspection and a trial run.

Transmission assembly



Electric motor and switchgear production.

The most modern standards are used in the production of special-purpose motors.

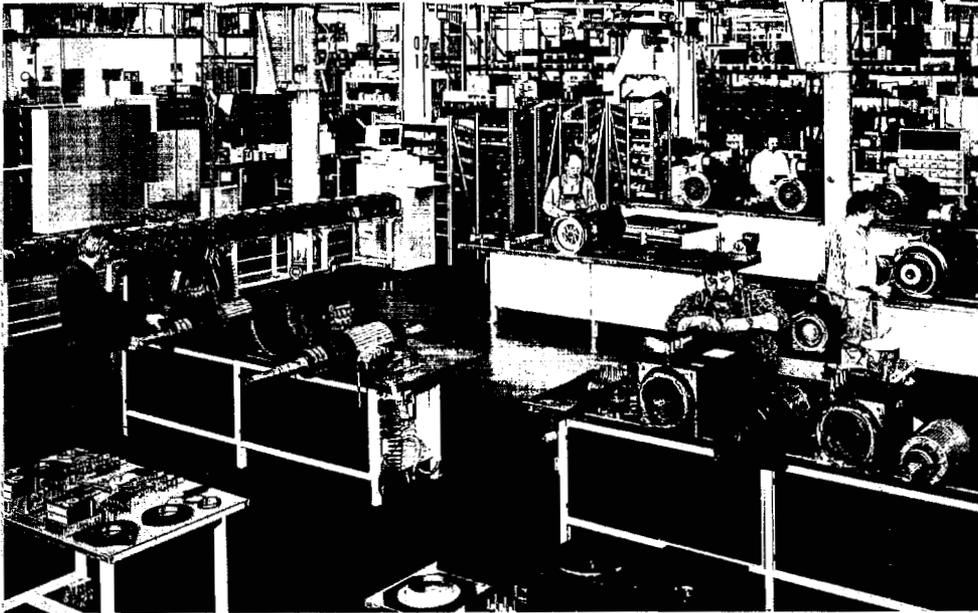
The production process includes stators, rotors, coils and housings.

The coils are sealed against moisture in state-of-the-art systems, using high-grade resin and lacquers.

The premium quality specifications which Liebherr applies to its products were the decisive factor in deciding to build switchgear cabinets as well in its own plant. At Liebherr these cabinets are produced with weights of up to 5,000 kg and with up to 6 kilometres of installed cable.



Electric motor production



Motor assembly

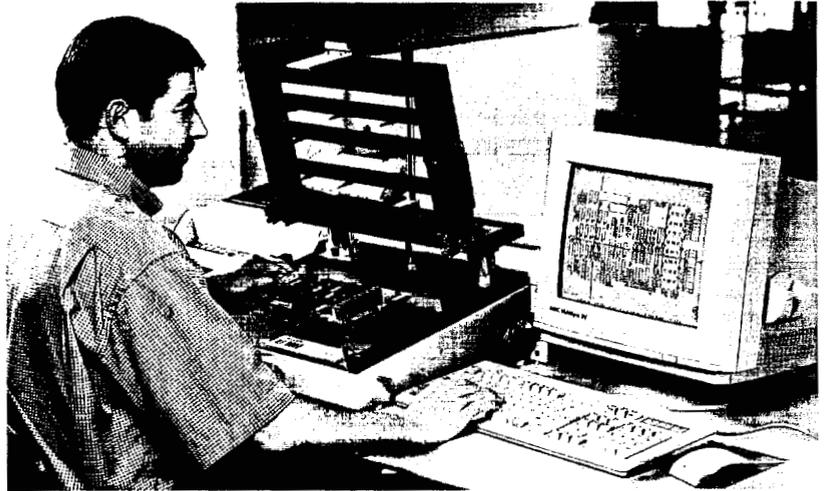


Switchgear cabinet assembly

Electronic systems production.

In the electronics area Liebherr supplies switchgear and control devices for construction, container and dockside cranes in both conventional technology and in form of Liebherr micro-processor control units. Alongside these tried-and-tested electronic components from drive train control technology, Liebherr also develops and manufactures micro-processor batching systems for concrete mixing as well as electronic components for use in earthmoving machinery.

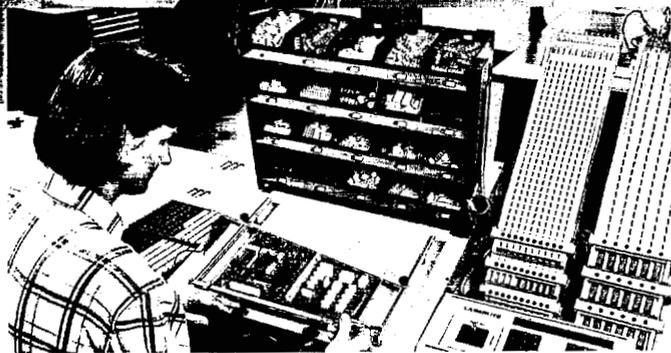
Modern production facilities and automated pick-and-place machinery in conjunction with computer-controlled test equipment ensure that these electronic systems are of top quality and extremely reliable.



Computer-controlled test equipment

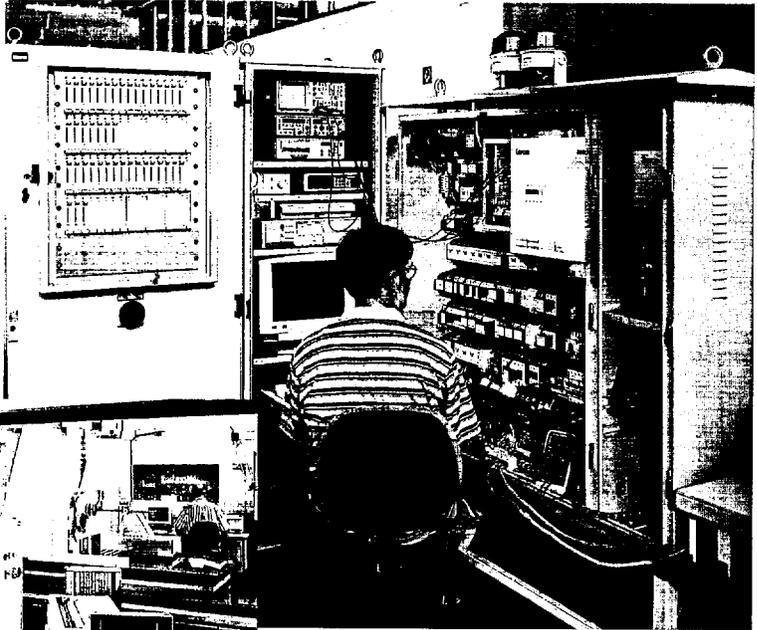


Automated soldering machine



Quality assurance.

The manufacturing procedures which Liebherr employs are an assurance of maximum precision and component reliability. The most up-to-date methods are employed to maintain quality standards for process approval and continuous production monitoring, for example measuring centres and instruments, twin-flank gear testing equipment, spectral-analysis units, ultrasonic devices and microscopes as well as dye penetration and magnetic-particle tests. All workpieces are measured on three-dimensional coordinate measuring devices.



Switchgear cabinet testing unit

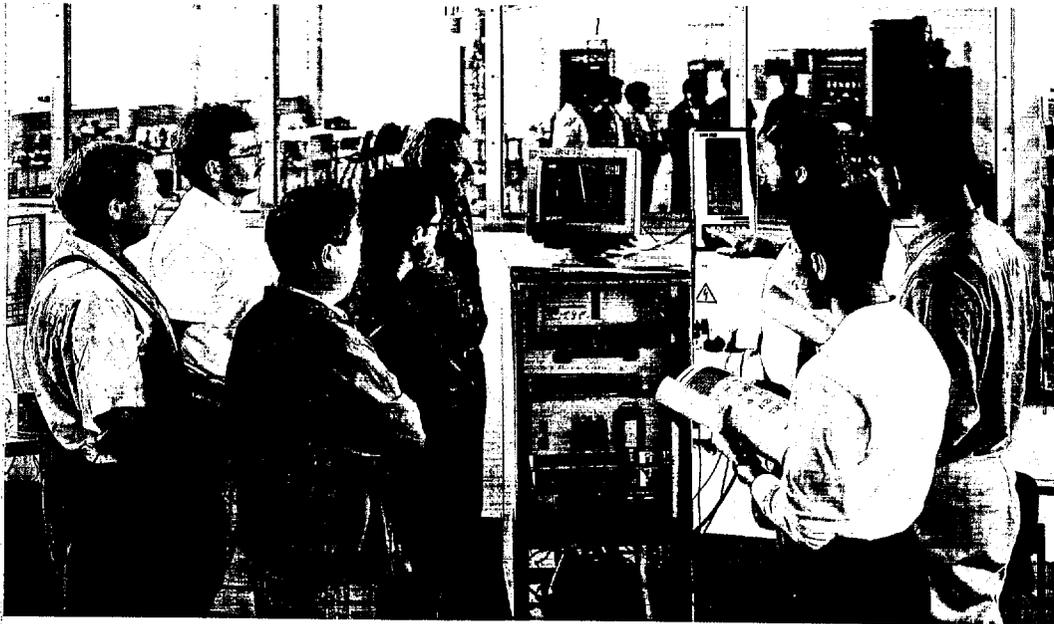


Fully-automated, computer-controlled, climatically-balanced measuring centre with three-dimensional coordinate measuring devices

Training and service.

Training facility

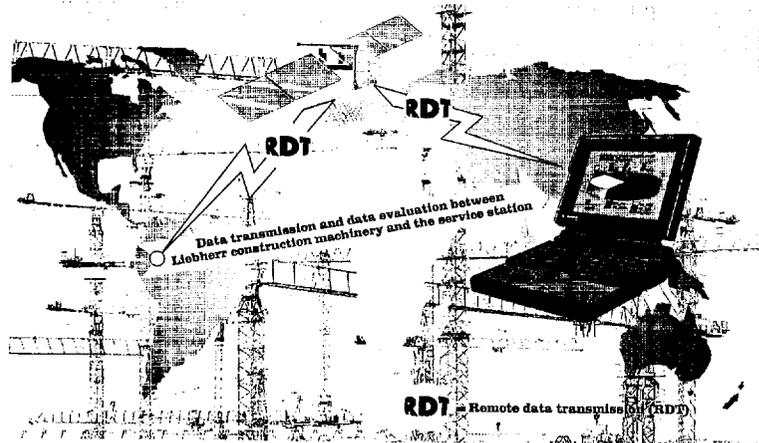




Training and presentation centre

Liebherr products are evidence of their manufacturer's high standards in the "intelligent" technology, perfect functionality and maximum quality areas. The requirements which the people who develop, build, operate and service these products must satisfy are similarly high. That is why Liebherr will continue to make above-average investments in basic and advanced training. This applies both to the training of new staff as well as follow-up courses for its own service personnel and that of its customers and dealers.

Highly-qualified teams located at service bases all round the world provide immediate, expert and appropriate advice and assistance. Technically-skilled staff can be despatched to the working site at short notice if required.

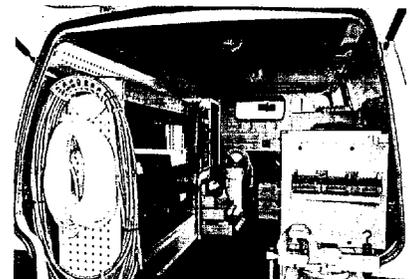


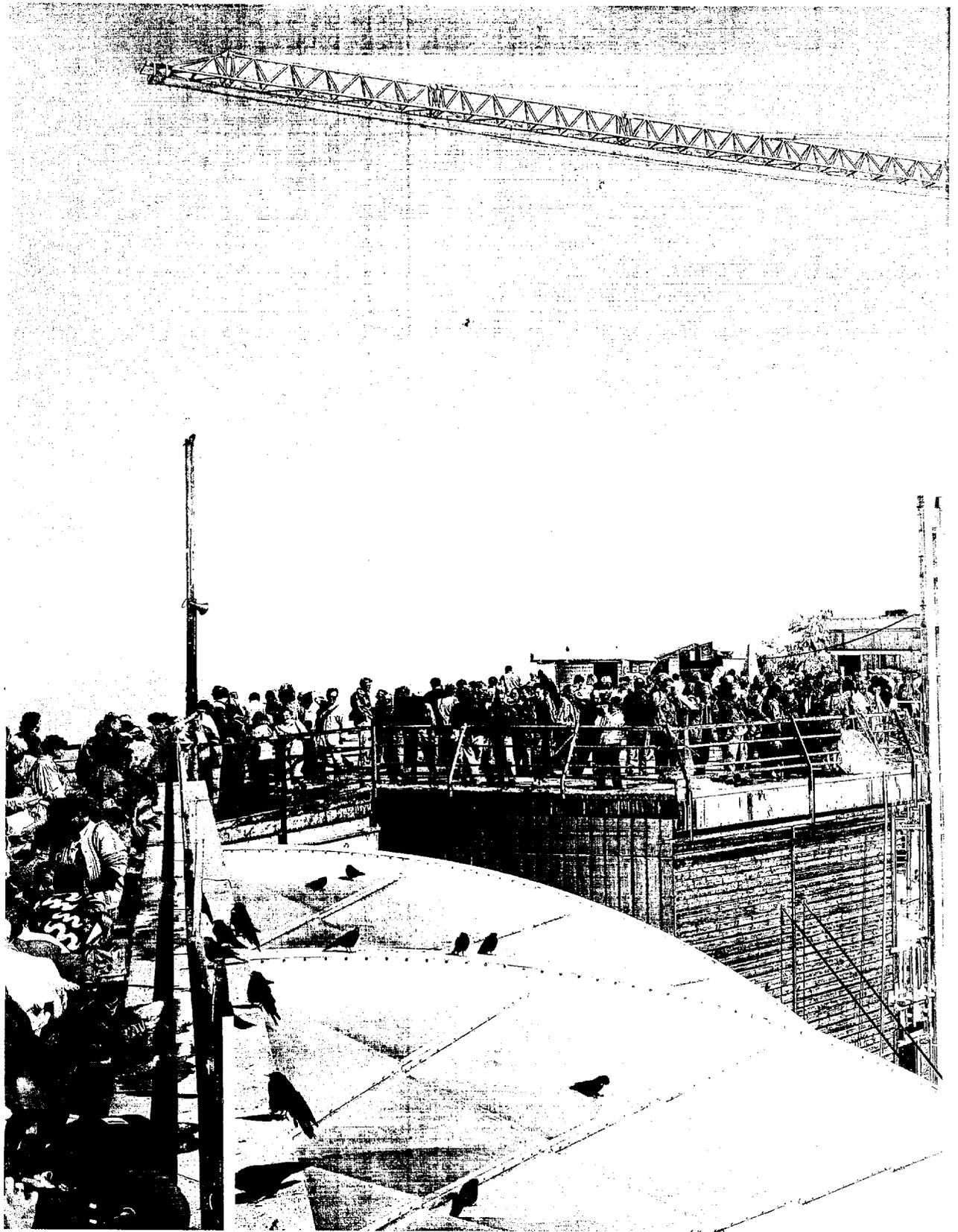
Worldwide tele-dialog between crane and service base

After-sales vehicles



An after-sales vehicle's equipment





An EC crane on the Zugspitze mountain in Germany, 2,964 metres above sea level

