OVER VIEW

LOESCHE

INNOVATIVE ENGINEERING

Loesche Technology – a Success Story

In 1927 Ernst Curt Loesche patented the world‘s first spring-loaded air-swept mill developed by him in Teltow near Berlin. And so began the unprecedented career of the Loesche roller grinding mill.

It all started with the grinding of coal at the Klingenberg power station in Berlin, the first coal-dust-fired power station in Europe.

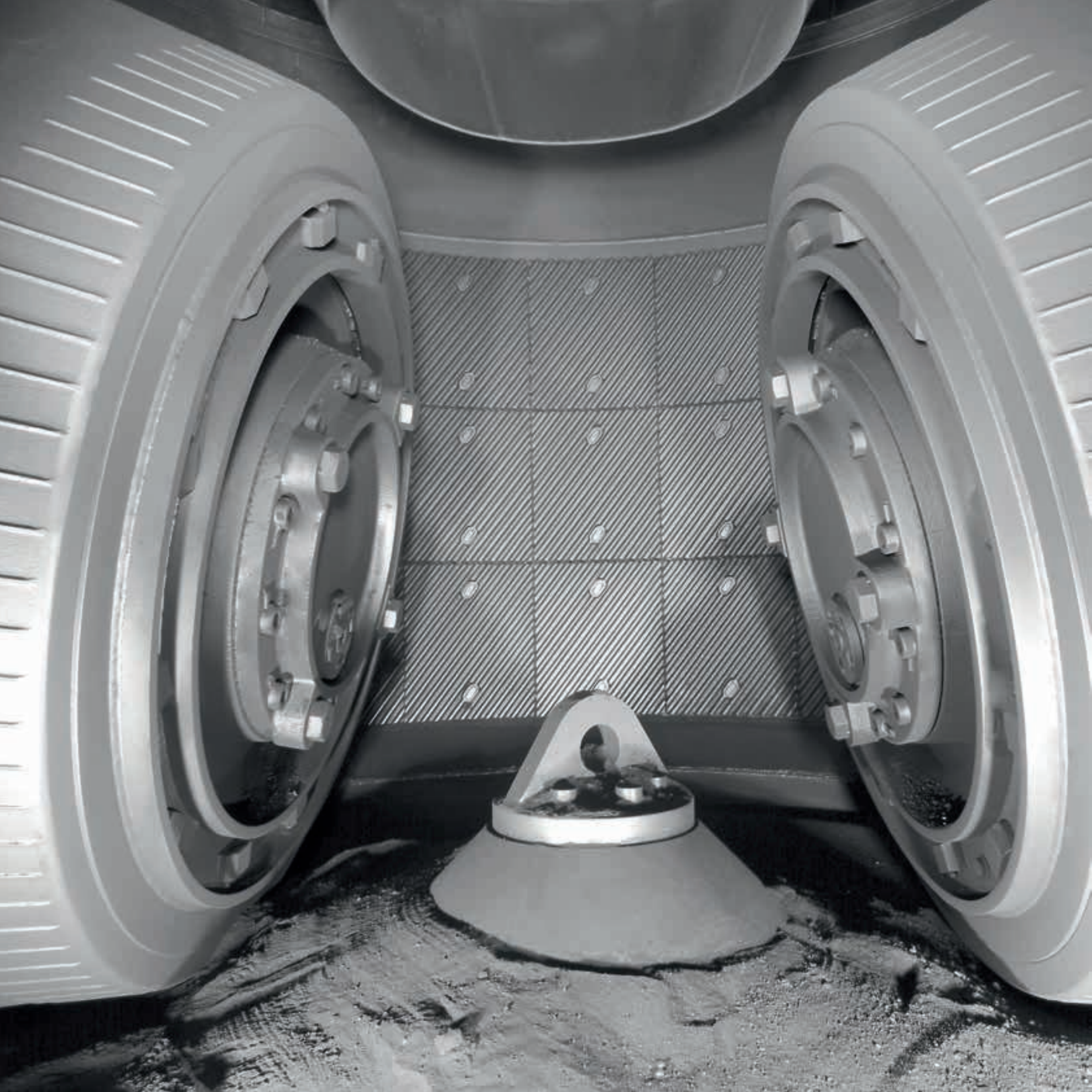
The technological and energy benefits of this new type of mill were so outstanding that the technology was very quickly carried over into other fields of application.

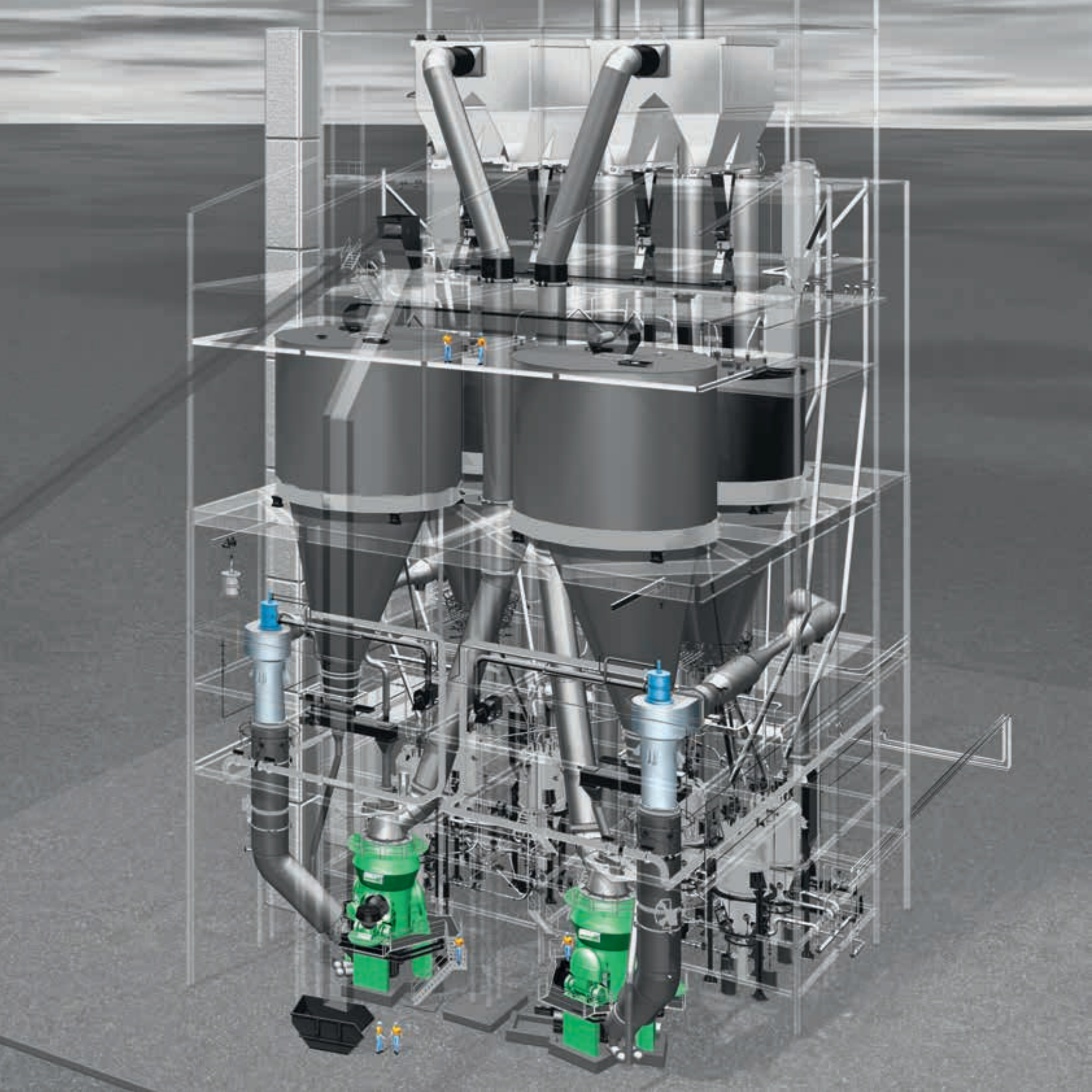
Today in the cement industry conventional grinding technology for raw meal, coal, cement and granulated blast furnace slag can be substituted entirely by vertical air-swept mills – thanks to Loesche.

Loesche also introduced this technology in the ore industry and for grinding of steel slag.

A defined product particle size distribution cannot be achieved without classification. Loesche developed highly efficient classifiers in tandem with grinding technology.

For optimum combined drying and grinding results Loesche‘s very own patented hot-gas generators have been around for decades. These generators have steel combustion chambers, no refractory material, are energy-saving and ahead of their time. They are known throughout the world as LOMA® heaters.





Loesche Product Line

– the right mill size for every throughput





Product rates for cement raw material of 1400 t/h and mill drive ratings exceeding 10 000 kW are managed as flawlessly as 2 t/h at 110 kW.

Naturally we also supply suitable associated machines for units to all mill sizes for example classifiers for finenesses > 7000 Blaine or d_{50} < 5 µm, and hot-gas generators ranging from 300 kW to 60 MW.

Loesche mills are supplied today for a multitude of applications. They are adapted to the comminution requirements of the respective material involved.

We supply:
· Mills for cement raw meal
· Mills for cement and granulated blast furnace slag
· Mills for solid fuels
· Mills for industrial minerals
· Mills for ores and steel slag
· Mobile grinding plants for solid fuels
· Mobile grinding plants for ores and slag

Loesche is the only mill supplier to have developed in-house hot-gas generator technology for burning:
· solid fuels
· low calorific value gases
· conventional liquid and gaseous fuels – a significant advantage for an optimum combined drying and grinding process.

The delivery of turn-key grinding plants is as much a part of our programme as the technological advice we offer in respect of energy-efficiency and environmental protection.

Loesche automation technology completes our product line.

We build complete grinding plants.

Mills for Cement Raw Meal

– from pure limestone to superfine clay

Loesche has always been consistently geared towards the needs of the cement industry. The increase in the throughputs of cement plants in connection with the introduction of new energy-saving technologies – from the wet process, through the semi-dry process down to the dry process – necessitated an increase in the capacities of the mills.

The basic model of the Loesche mill was further developed with a high degree of inventiveness. This is made apparent in the mill sizes, the throughputs and the accompanying technological innovations, such as

- a new hydropneumatic spring assembly
- the introduction of a modular construction
- the availability of exchangable assemblies for building 2-, 3-, 4- and 6-roller mills

The use of large mills reduces investment costs.







Mills for Cement and Granulated Blast Furnace Slag

– new roller concept, highest fineness

In 1935 Loesche supplied a first cement mill to Brazil. Then, the time was not yet ripe to establish the grinding of cement in vertical mills. It was to be almost another 50 years before the cement industry introduced this modern grinding technology. The finenesses required for cements place the highest demands on the new grinding technology.

Innovative engineers from Loesche came up with a solution for grinding very fine materials and from it created a new grinding-roller concept – the 2+2 or 3+3 technology, i.e. half the rollers, also called the master rollers, are used for grinding. The other rollers, called the support rollers, prepare the grinding bed in order to control the specific properties of the very fine material.

This new roller concept was accompanied by further innovations:

- significantly higher grinding pressure
- variable grinding pressure during grinding, depending on the specific surface area to be achieved (Blaine)
- very low differential speed between roller and grinding track
- low specific wear during superfine grinding
- hardfacing with mobile welding equipment possible.

All cement factory mills are now “vertical” and can be supplied by Loesche.



Mills for Solid Fuels

– it all began with coal

The world‘s first spring-loaded air-swept mill patented by Loesche in 1927, already demonstrated all the essential features of modern vertical air-swept mills. This first mill incorporated an integrated dynamic classifier. The first shock-resistant pressure mill came onto the market in 1965, in response to tightened safety requirements. In 1980 Loesche patented the modular mill construction, enabling identical components to be used in different mills. In 2008 the 800th coal mill was sold. With the world‘s first self-inert coal grinding plant in a German steelworks, Loesche played a significant role in the introduction of PCI technology (Pulverised Coal Injection) – to this day we are the market leader in this field.

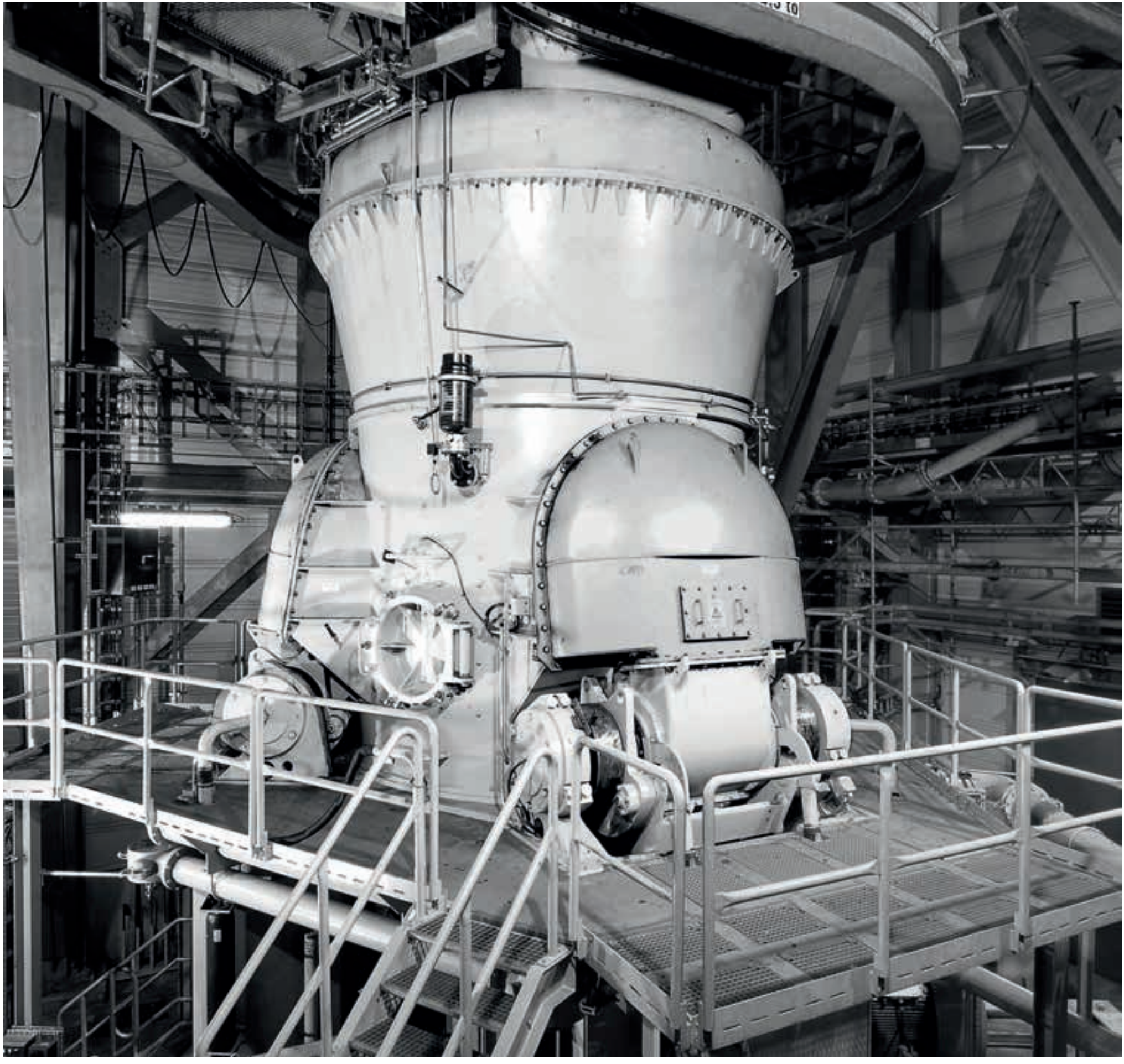
Keep it solid and simple – Loesche builds safe and reliable roller grinding mills and coal grinding plants in accordance with this motto.

Important features here are:

- no metallic contact between the grinding parts, even when the mill is empty; thus no sparking
- individual guidance of the grinding rollers ensures low-vibration mill operation even in the partial-load range down to 20 %
- the hydropneumatic counter pressure system makes it possible to grind a multitude of different fuels – both hard and soft
- mill design with 2, 3, 4 or 6 rollers for fuel throughputs up to 350 t/h

Loesche‘s development of self-inerting grinding plants in the mid-1970s provided the crucial foundations for the safety concepts associated with the grinding of solid fuels.





Mills for Industrial Minerals

- complete or partly complete delivery to the construction site

When it comes to mineral raw materials the industry demands throughputs of between 5 t/h and 80 t/h. The main throughput range is 5 t/h to 25 t/h. The required finenesses range between 1 % R 25 µm and 1 % R 300 µm.

Loesche has developed a special mill series to meet these needs.

Our top-selling mill sizes in this market segment are the LM 12.200 and the LM 15.200, which fall within the main throughput range.

These new Loesche mills with complete or partly complete delivery to the construction site offer our customers significant advantages such as:

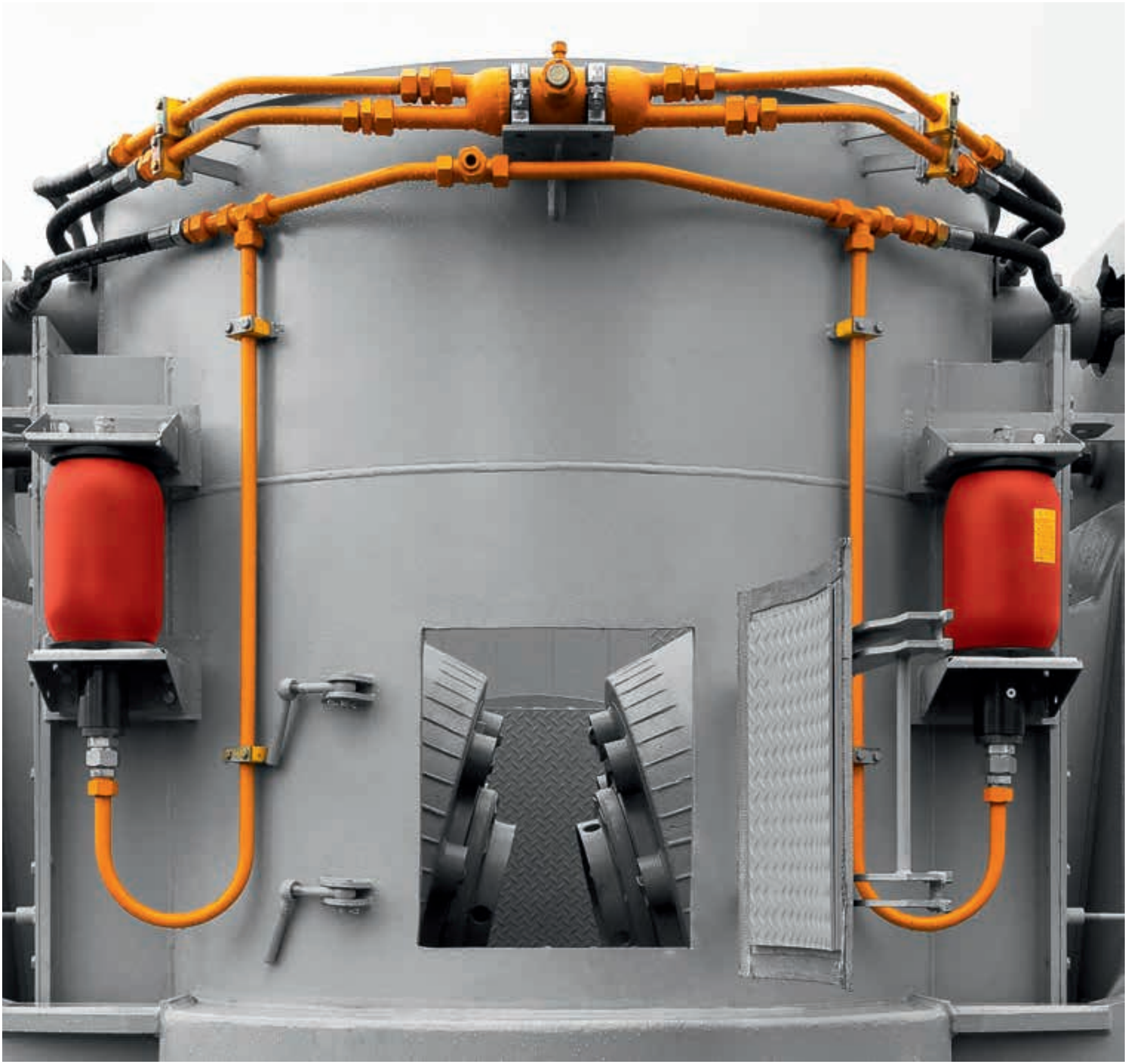
- short delivery times
- completed planning documentation for all mills
- significant shortening of site assembly, thanks to complete preassembly or preassembled components
- ease of maintenance thanks to good accessibility

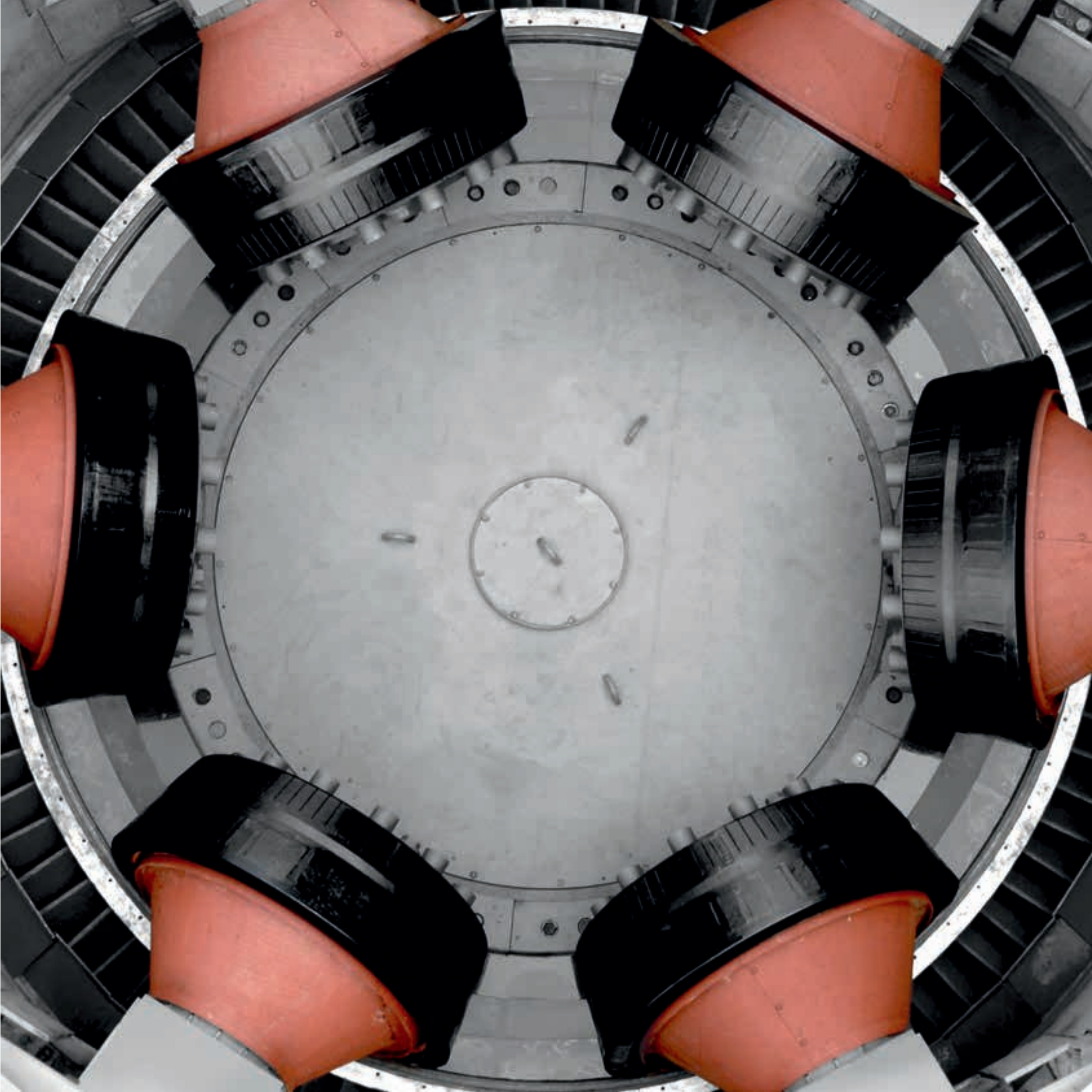
In our company history stretching back over more than 100 years we have supplied many branches of industry with plants for grinding limestone, dolomite, marble, barite, chalk, quick lime, bentonite, colemanite, phosphate rock, anhydrite, talc, manganese dioxide, magnesite, and other materials.

Small but fine (milled).









Mills for Ores and Steel Slags

– the variety of ores requires high technical variability

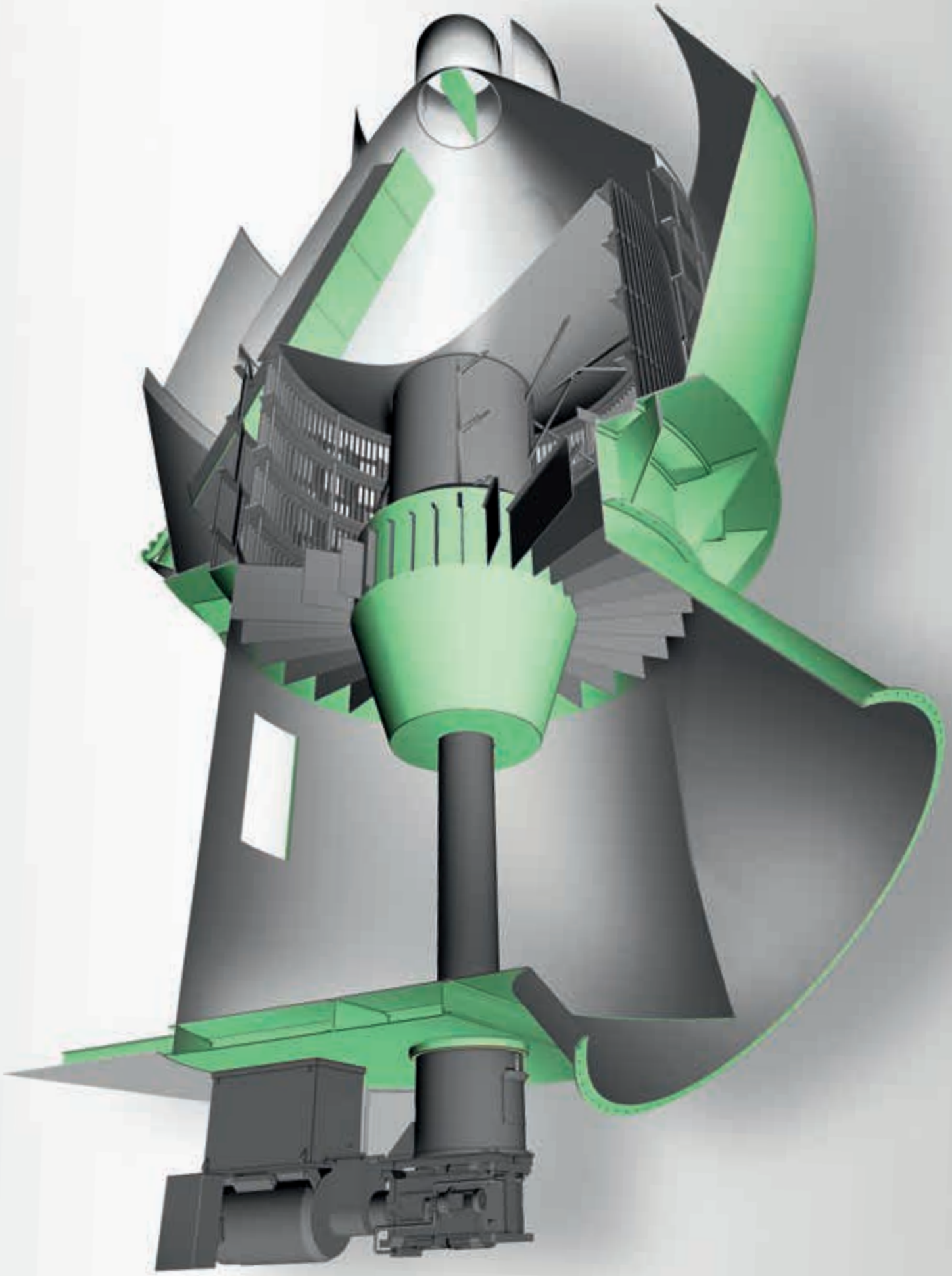
Conservation of resources was an important motivating force for Loesche and resulted in the introduction of vertical air-swept mills for grinding ores. Dry-grinding avoids the use of water, which is particularly important in arid climates.

Loesche grinding technology demonstrates further significant advantages over conventional grinding systems:

- Energy savings of between 30 % and 40 % thanks to low specific energy consumption
- Steep product particle size distribution
- Reduced product overgrinding
- Inter-particle comminution in a material bed
- Selective comminution
- Higher degree of liberation of the valuable minerals
- Combining of the process steps of crushing, grinding, sorting, drying and classifying
- Rapid response to changes in the material composition and characteristics
- Dry grinding product has a positive effect on the downstream processes
- Compact construction
- Mill throughputs up to 1400 t/h

We are not “ore”-conservative – that is why we use vertical mills for this.





Classifier, integrated in the Mill

- efficiency of separation, fineness, particle size distribution

The Loesche vertical mill is characterised by the fact that several processes – comminution, drying and classifying – can be implemented in a single machine. Since the birth of the Loesche mill back in 1927 we have devoted ourselves just as much to classifying as we have to the grinding process. This is because only highly efficient classifying delivers the desired product quality.

In addition to the operating parameters of the classifier itself – such as separation efficiency or pressure loss – the materials to be classified also play a role.

The lamellar classifier developed in 1928 was followed by pressure-shock-resistant classifiers for coal mills, rotary classifiers for very moist materials and louvre classifiers for example for creating fine and coarse products. Rotary and louvre classifiers were later combined. The LSKS, which is tailored to processing the often very moist granulated slags, has been available since the beginning of the 1990s. Today this type of classifier is standard for all materials.

Thanks to intensive research and analysis of the system parameters in CFD simulations and model tests it has been possible to optimise the gas/dust flow patterns. The guide vane assembly and the rotor offer a lower resistance to flow than before and provide an improved classification efficiency. This leads to higher energy efficiency and less wear.

The new LDC Series (Loesche-Dynamic-Classifier) is optimally matched to the Loesche mills. Upper housings with a rectangular horizontal outlet and a round sloping outlet are available.

Using the patented swirl rectifier brings about a more homogeneous dust and gas distribution in the filter.

Here it‘s all about fineness.



Mobile Grinding Plants

- perfectly natural to us

In the technological field we cannot dispense completely with the use of fossil fuels. We must however, depending on resources, turn to coal in order not to destroy the declining supplies of purer energy sources such as oil and gas.

In response to this finding Loesche developed a mobile coal grinding plant (**CGP** Coal Grinding Plant) which produces 2–4 t/h coal dust for a thermal output of approximately 5–20 MW. The newly developed container-construction plant provides for the local supply of thermal processes and can be used at any site.

This plant type fills the gap in the supply of coal dust in that it eliminates long transportation routes in special vehicles. The use of coal instead of gas and oil that is made possible by this plant reduces operating costs dramatically.

To introduce new processing technologies in the ore industry – in this case a dry processing method – Loesche also developed a transportable, fully-equipped container-based grinding plant (**OGP** Ore Grinding Plant). This plant is designed in such a way that it can be transported to practically any geographical and climatic region in the world where mining operations are conducted.

Loesche‘s purpose with this plant is to enable ores to be immediately ground directly on site in an ore processing plant without intermediate transportation so as to prevent potential changes to the grinding stock. The material behaviour in the downstream processes can be analysed immediately.

The customer is able to evaluate process variants realistically and to determine economically in the short term the influences on the production of valuable substances in his plant.

The mill for the in between.







Hot-gas Generator with Steel Combustion Chamber

- a milestone

For the combined drying and grinding process a heat source is required to dry the grinding stock – this is usually a hot-gas generator. At the beginning of the 1960s Loesche built the first combustion chamber with no refractory lining. This signalled the start of a success story.

Loesche was and is the only mill manufacturer that can supply all the equipment in-house, i.e. the mill with its own hot-gas generator.

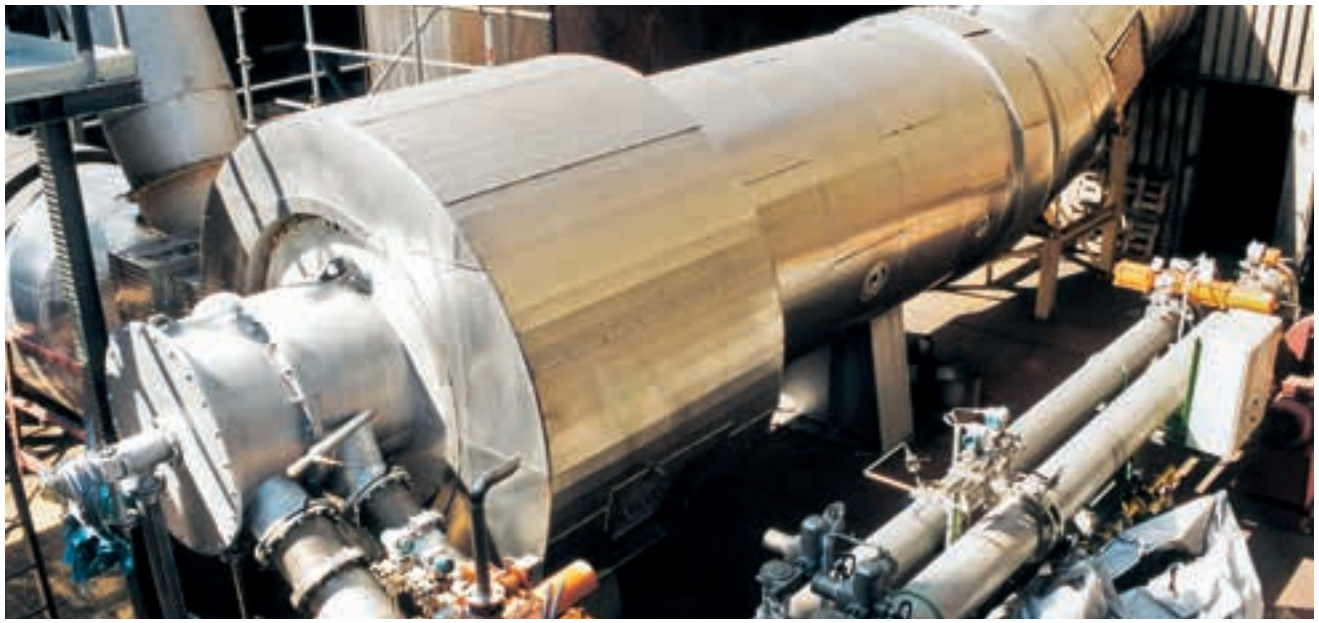
The Loesche combustion chamber, known around the world by the name LOMA heater (**LO**ch**MA**ntel = German for perforated jacket), initiated the age of steel combustion chambers with no refractory linings and is the prototype of all these combustion chambers which are used today worldwide for all kinds of thermal processes.

The first decades in the story of the LOMA® heater were marked by the use of conventional gases and liquid fuels.

Increased energy awareness and the scarcity of pure energy sources gave rise to a high demand for energy-efficient processes and the call for the use of alternative fuels.

The basis for the development of new hot-gas generator systems by Loesche was on the one hand gaseous industrial by-products such as blast furnace gas, coke gas, synthesis gas, etc. and on the other hand the increased use of all manner of solid fuels – from wood dust, through to pulverised lignite and pulverised hard coal, as well as petroleum coke.

We recognise the signs of the times – energy efficiency and ecological awareness.



Our burner systems

– ready for all fuels for outputs from 0.1 MW to 60 MW

Loesche burners are used in a variety of industries for drying, heating, temperature control, power and steam generation.

Output ranges from 0.1 to 60 MW are reached through a large number of applications and optimised fuel burners. Loesche engineers advise clients on a project-specific basis on whether gaseous, solid, liquid or powdered fuel offer optimum energy efficiency and fuel costs. More than 600 reference plants have been erected worldwide in the cement, power generation, steel, minerals, ore, timber, animal feed and chemical industry already.

At the beginning of the 1990s Loesche engineers succeeded in combining the Loesche steel combustion chamber with a new type of burner to create a new hot-gas generator system. This marked the birth of the multiple lance burner, or MLB for short. This burner enables lean gases with heating values down to a minimum of 2800 kJ/m³ (STP) to be burned with great efficiency without the need for combustion assistance.

Within just a few years the MLB was in use all around the world, primarily in the steelworks industry for the thermal utilisation of blast furnace gas.

For coal gasification processes a modified MLB is used to burn synthesis gas. This burner has been successfully used since the construction of the first industrial coal-to-gas plant in the Netherlands in 1990.

The process of coal grinding requires high control ranges of 1:10, which can be achieved with the Loesche hot-gas generator systems.

This burner system represents the state of the art in engineering since the beginning of the 1990s.

Even in the early days the advantages of the Loesche steel combustion chamber were already being exploited in the burning of solid fuels. In the 1980s the wood industry played a pioneering role in the utilisation of industrial solid fuels. Thanks to continuous further development pulverised lignite and pulverised hard coal can also be efficiently burned today.

In order to conduct combustion testing of solid fuels from all kinds of sources Loesche built a 1 MW hot-gas test plant which is connected online to a Loesche coal mill.

This plant enables Loesche to determine the combustion parameters for any solid fuel under real conditions.



Automation Technology

– regulates and controls the heart of the machine

Loesche automation technology integrates cutting-edge machine technology and intelligent process control for optimum and efficient plant operation.

We offer our customers customised engineering services for process, hardware and software development.

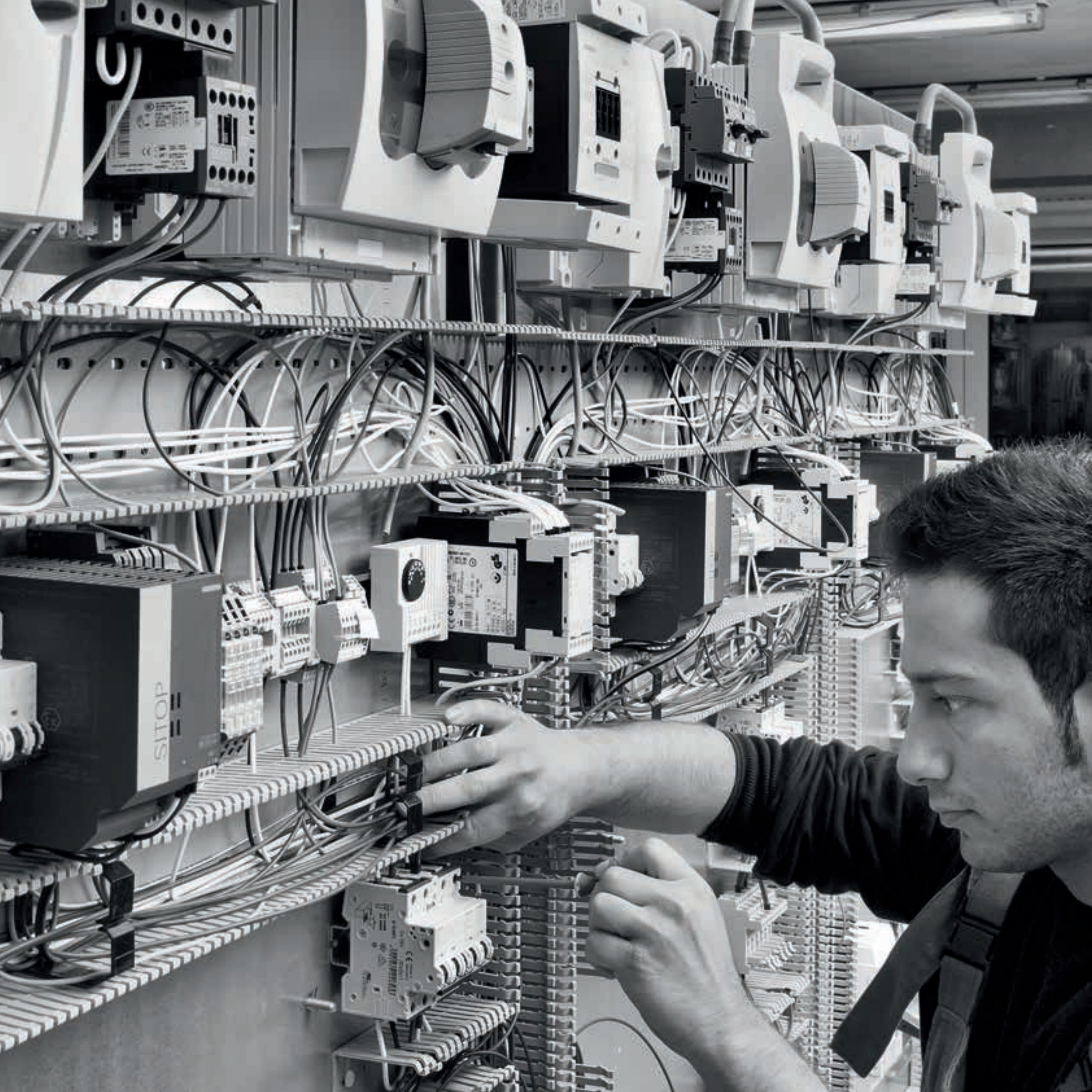
These services cover all disciplines ranging from open-loop and closed-loop control engineering, through to the full on-site supply of electrical equipment down to service, maintenance and customer training.

On the back of decades of experience Loesche develops intelligent control engineering solutions specifically for individual customers even for complex process engineering requirements.

Loesche automation completes our scope of services. This enables us to offer and supply customers with turnkey grinding plants from a single source and to maintain these plants in our capacity as a lifetime partner.

We can monitor and control.

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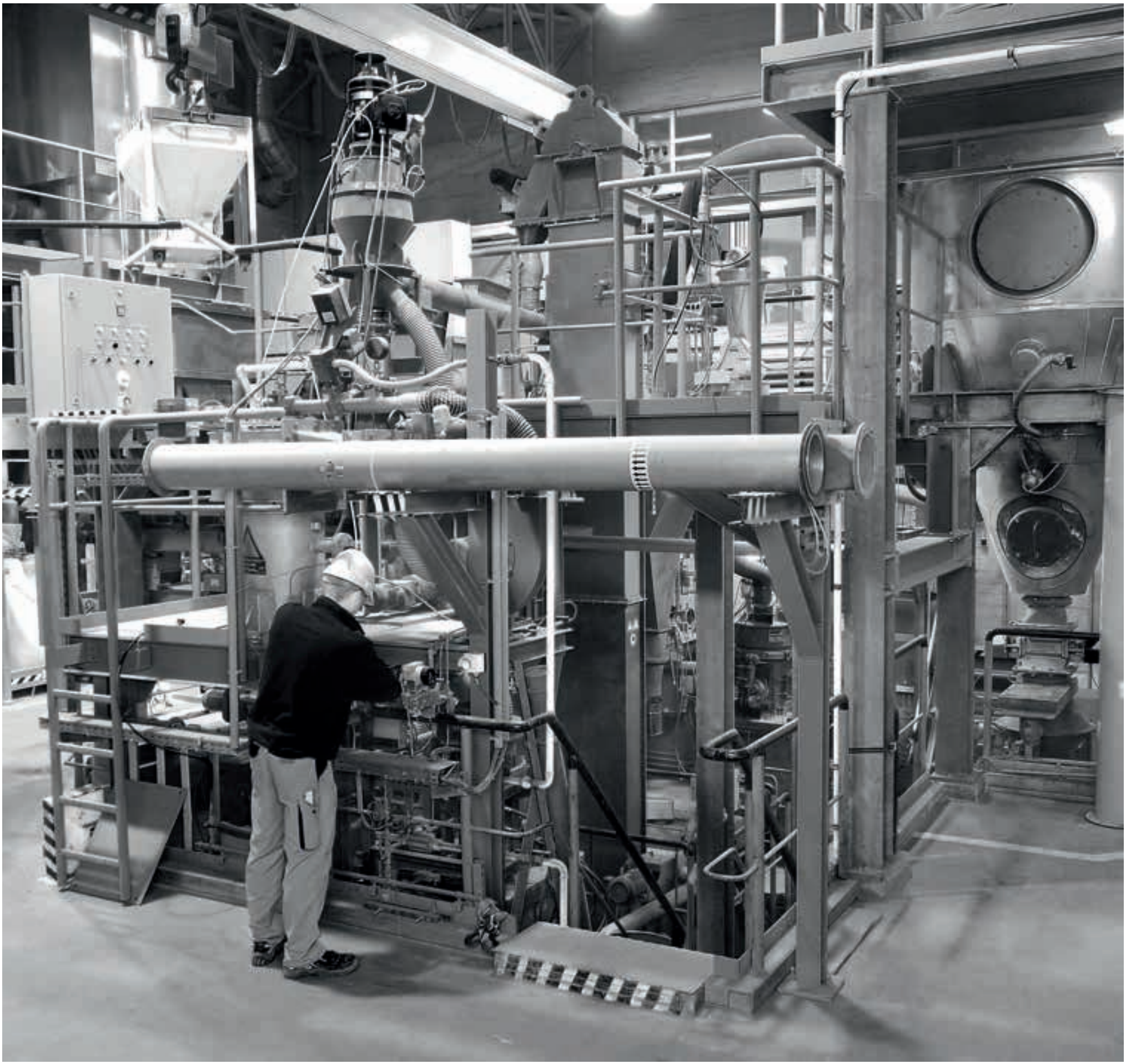


Research and Development

– the basis for innovative engineering

One of the first steps in developing and launching new technologies involves practical testing at the technical centre.

For our research and development projects we have four test grinding plants for a variety of purposes:
- Trials of new grinding technologies and classifiers
- Testing of client specific raw materials
- Analysis of grinding stock for future market segments
- Optimisation of plant components and circuits
- Testing of new grinding stock for future market segments
- Analysis and testing of new wear materials and concepts
- Development of hot-gas generator plants for burning solid fuels and lean gases

For grinding tests within the framework of projects or for special customer requests we operate at the Loesche test centre LM 3.6 type grinding plants for all kinds of applications and tasks.

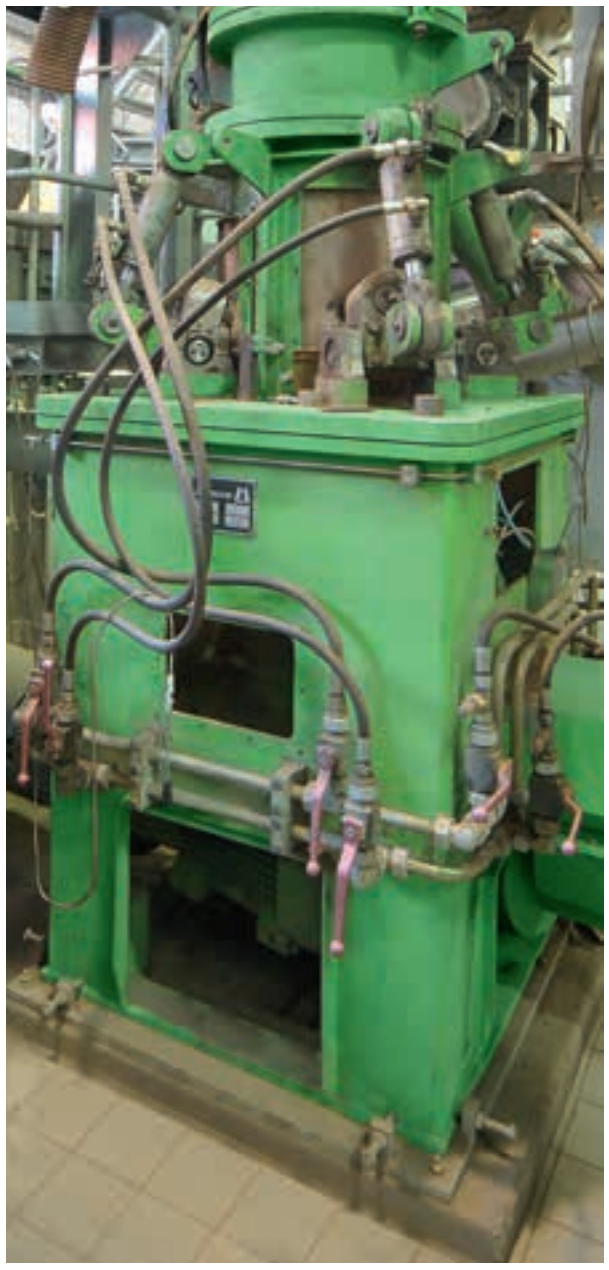
The most important key figures for a grinding stock are the Loesche grindability and the specific power demand, as related to a defined product fineness.

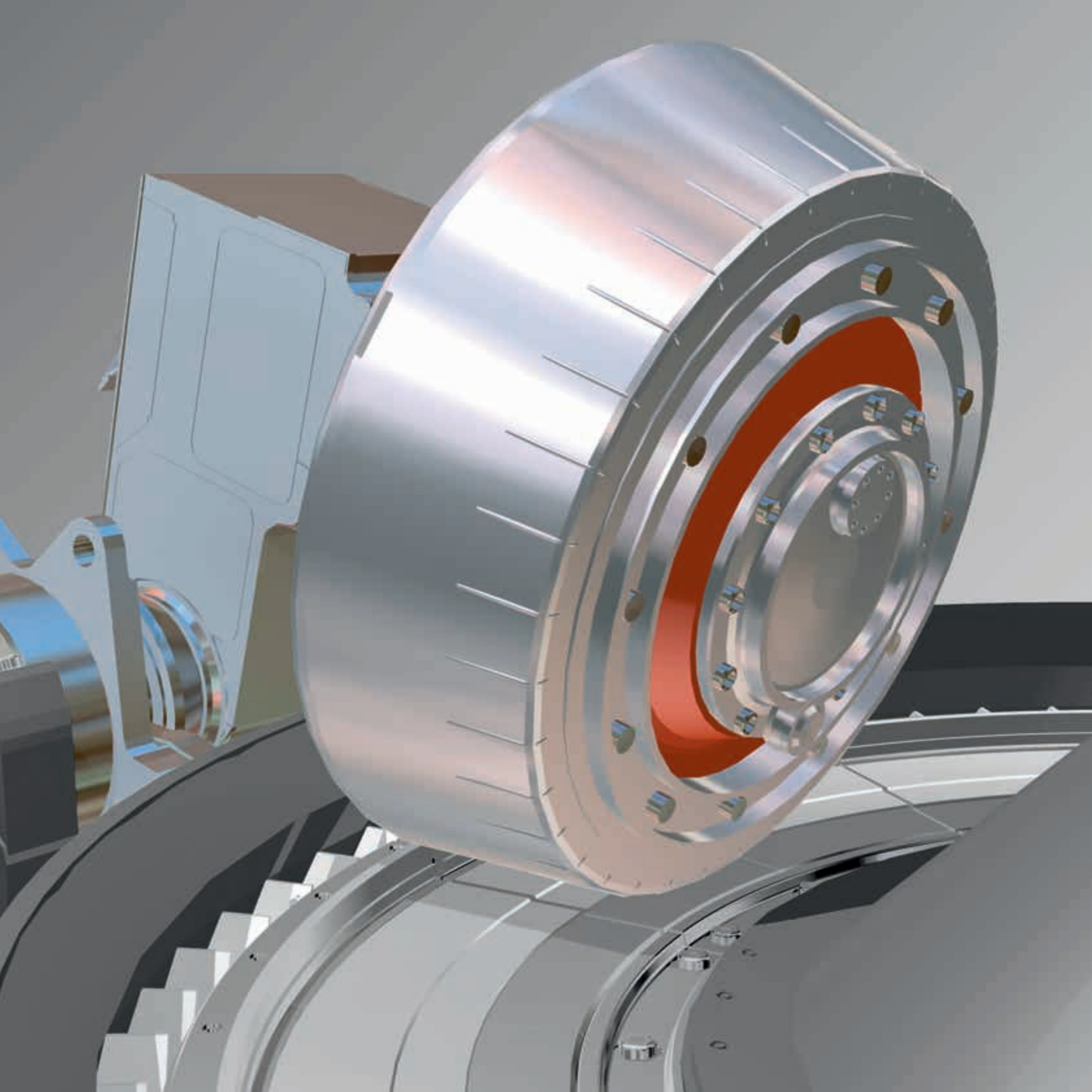
Depending on the geological origins of the grinding stock in nature one finds highly differing properties even in evidently similar materials.

In industrial products differences in material are common and depend on the respective process situation.

Analysis possibilities:
- Particle size analysis with Cilas laser granulometer
- Determination of mass-related surface area according to Blaine
- Determination of true density with gas pycnometer
- Sieve analyses with Alpine air-jet sieve and Retsch vibratory sieve
- Grindability according to Hardgrove
- Grindability according to Zeisel
- Microscopy with Zeiss Stemi SV 11
- Drying chambers for determining moisture
- Coal analysis (Cfix, volatile constituents, ash content).

Materials:
- Coal
- Cement, granulated slag
- Cement raw meal
- Ores and slag
- Industrial minerals
- Biomass.





Technology – Innovations

– we never rest on our laurels

Reducing grinding part wear
Wear is encountered in all comminution processes. The primary type of wear in the grinding roller/grinding plate system is abrasion, i.e.:
· Hard particles penetrate into the grinding wear components
· The depth of penetration is dependent on the hardness of the grinding component
· Multiphase materials (chilled casting – embedded carbide) are subject to local score grooving processes, resulting in a selective erosion.

Loesche offers the right material to suit every application. In practice three different groups of materials have proven successful for grinding elements:
· Cast iron with high chromium content
· Hardfaced steel casting
· Composite materials

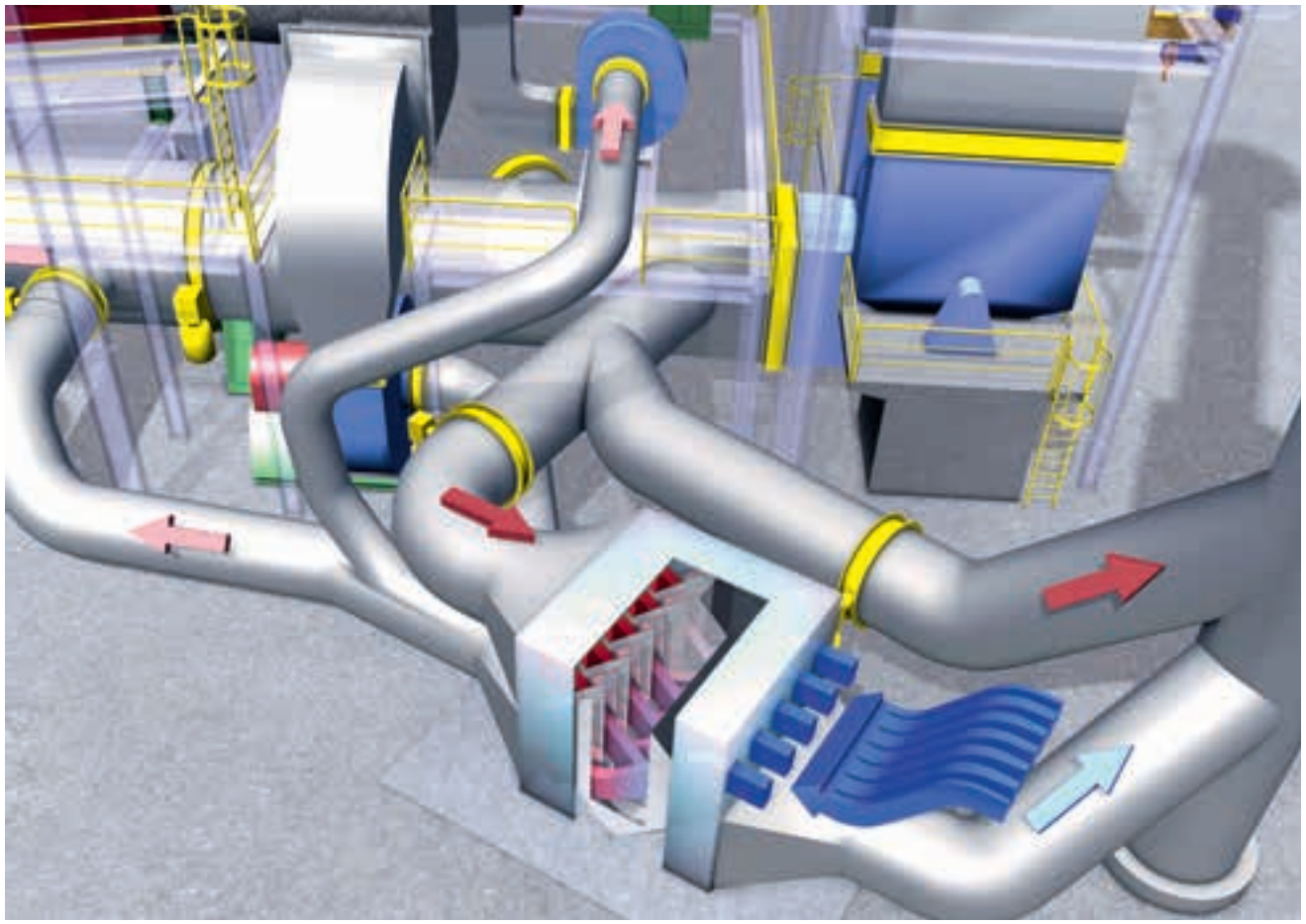
Heat recovery from process waste gases
In combined drying and grinding some of the process gas after leaving the dust separator is fed back into the grinding circuit. The rest is lost through the stack. A new process sequence allows some of the heat loss flow dissipated at the stack to be made available again for the grinding process. This process gas is routed through an air-to-air heat exchanger and preheats the required fresh air in the system.

The advantages:
· Annual fuel cost savings of between 10% and 15%
· The additional investment in the optimised heat recovery/heat utilisation system has a pay-back of 1 and 2 years

Improved roller seal
In order to increase the efficiency of grinding plants Loesche now offers a rocker arm seal which reduces energy costs and provides for a complete seal.

The new Loesche seal prevents false air from entering between the rocker arm and the mill body and seals off this area completely.

Always committed to progress and benefit of our customers.





Recovering metals and producing filler from steelworks slag

The scarcity of resources is increasingly forcing engineers to tap industrial by-products as "sources of raw materials". By developing new processes Loesche addresses both the challenges of environmental technology and the economic constraints of conserving resources in the form of its "recovery philosophy".

The dry reduction process developed by Loesche for recovering metals from slag combines all the advantages of conventional processes:

· Efficient and cost-effective metal recovery in the coarse range
· Virtually 100% metal yield down to the finest grain range by means of optimised dry grinding, classification and finest grain sorting technology
· Production of a high-quality mineral filler product with precisely definable grain distribution.

The process is particularly suitable for
· slag from the production of stainless steels
· LD slag, and
· metallurgically modified slag

Recycling of oil-contaminated scale

Oil-contaminated scale is one of the most difficult materials to recycle and is created during the hot forming of steel. The iron content of the dewatered scale lies between 65% and 70%.

The patented process developed by Loesche exhibits the following attributes:

· The oil-contaminated scale is added in a specific relationship to the raw coal at its storage point.

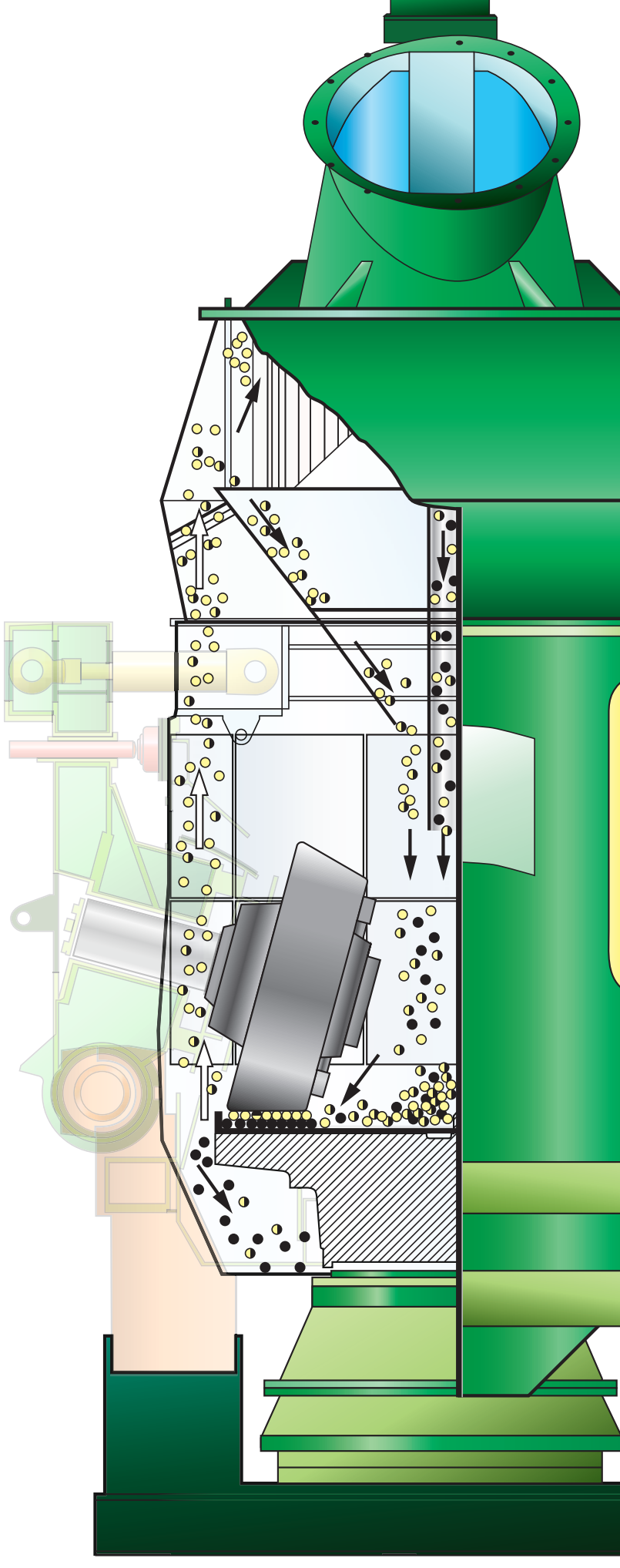
· The coal and scale mixture is transported to the bunker.

· The drying and grinding process creates an optimal homogenising and comminution of both components.

· The pulverised coal and scale mixture is fed via the dosing unit and the injectors into the blast furnace.

· This process of drying and grinding the coal-scale mixture can be planned into the erection of new PCI plants as well as being retrospectively fitted to existing plants. This process requires no extra, expensive equipment.

The process has been successfully integrated into the production lines of three coal mills at the Dillinger Hutte steelworks in Germany. It ensures that the oil-contaminated scale is effectively reintroduced to the smelting process.



Loesche GmbH
Hansaallee 243
40549 Düsseldorf
Tel. +49 - 211 - 53 53 - 0
Fax +49 - 211 - 53 53 - 500
Email: loesche@loesche.de
www.loesche.com

Brazil
Loesche Equipamentos Ltda.
Rua México 119 sl. 1908
20031-145 Rio de Janeiro, Brazil
Tel. +55 - 21 - 22 40 79 00
Fax +55 - 21 - 22 20 94 40
Email: loesche@terra.com.br

Germany
Loesche Automatisierungstechnik GmbH
Zum Pier 52
44536 Lünen
Tel. +49 - 231 - 98 70 10
Fax +49 - 231 - 98 70 10 - 20
E-mail: info@loesche-automation.de
www.loesche-automation.de

Loesche ThermoProzess GmbH
Küppersbuschstraße 2
45883 Gelsenkirchen
Tel. +49 - 209 - 401 - 0
Fax +49 - 209 - 401 - 520
E-mail: info@loesche-tp.de
www.kueppersbusch.cc
www.loesche-tp.de

India
Loesche India Pvt. Ltd.
D - 83, Sector - 2
Noida - 201301
U.P., India
Tel. +91 - 120 - 40 18 500
+91 - 120 - 24 44 205 - 207
Fax +91 - 120 - 40 18 590 - 91
+91 - 120 - 24 43 327
Email: loesche@loescheindia.com
www.loescheindia.com

People's Republic of China
Loesche Mills (Shanghai) Co., Ltd.
No. 568, Jinhong Road
(near No. 555, Chunhe Road)
Baoshan District,
201901 Shanghai, P. R. China
Tel. +86 - 21 - 5180 6100
Fax +86 - 21 - 5180 6101
Email: info@loesche.cn

Loesche Mills (Shanghai) Co. Ltd.
5 Dongzhimen South Street
Room 817-818, CYTS Plaza
Dongcheng District,
100007 Beijing, P. R. China
Tel. +86 - 10 - 5815 6205
Fax +86 - 10 - 5815 6220
Email: info@loesche.cn

Russia
OOO Loesche
Berezhkovskaya Naberezhnaya 16a/2
P.O. Box 97, 121059 Moscow
Russian Federation
Tel. +7 - 495 - 988 50 81
Fax +7 - 495 - 988 60 86
Email: info@loesche.ru
www.loesche.ru

Socialist Republic of Vietnam
Loesche GmbH Viet Nam
Representative office
60 Nguyen Dinh Chieu Str.
Dakao Ward, Dist. 1
HCM - Ho-Chi-Minh City,
Tel. +84 - 8 - 39 10 45 62
Fax +84 - 8 - 39 10 45 26
E-Mail: mai.lam@loesche.vn

South Africa
Loesche South Africa (Pty.) Ltd.
55 Empire Road, Empire Park, Block C
2193 Parktown, South Africa
Tel. +27 - 11 - 482 29 33
Fax +27 - 11 - 482 29 40
Email: loesche4@global.co.za

Spain
Loesche Latinoamericana S.A.U.
Condesa de Venadito 1, Planta 4
28027 Madrid, Spain
Tel. +34 - 91 - 458 99 80
Fax +34 - 91 - 457 10 17
Email: loesche@loesche.es
www.loesche.es

United Arab Emirates
Loesche Middle East FZE
P.O. Box 262 622
Jebel Ali, Dubai, U.A.E.
Tel. +971 - 4 - 886 59 11
Fax +971 - 4 - 886 59 22
Email: info@loesche.ae

United Kingdom
Loesche Energy Systems Ltd.
2, Horsham Gates
North Street
Horsham, RH135PJ, United Kingdom
Tel. +44 - 1403 - 223 101
Fax +44 - 1403 - 223 102
Email: loesche@loesche.co.uk

USA
Loesche America, Inc.
20170 Pines Boulevard, Suite 301
Pembroke Pines
Florida 33029, USA
Tel. +1 - 954 - 602 14 24
Fax +1 - 954 - 602 14 23
Email: webmaster@loescheamerica.com
www.loescheamerica.com

REVIEW

Detailed information about the Loesche products outlined in brief here can be obtained from the product-specific brochures available at **www.loesche.com**

LOESCHE

INNOVATIVE ENGINEERING