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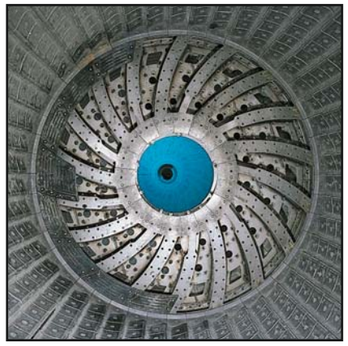
Konzept und Gestaltung Kulms & Halbur Lippstadt · D-Sch. / 2.3-01 engl. / 9.04

Mill Diaphragms



Christian Pfeiffer

Technology and Know-how

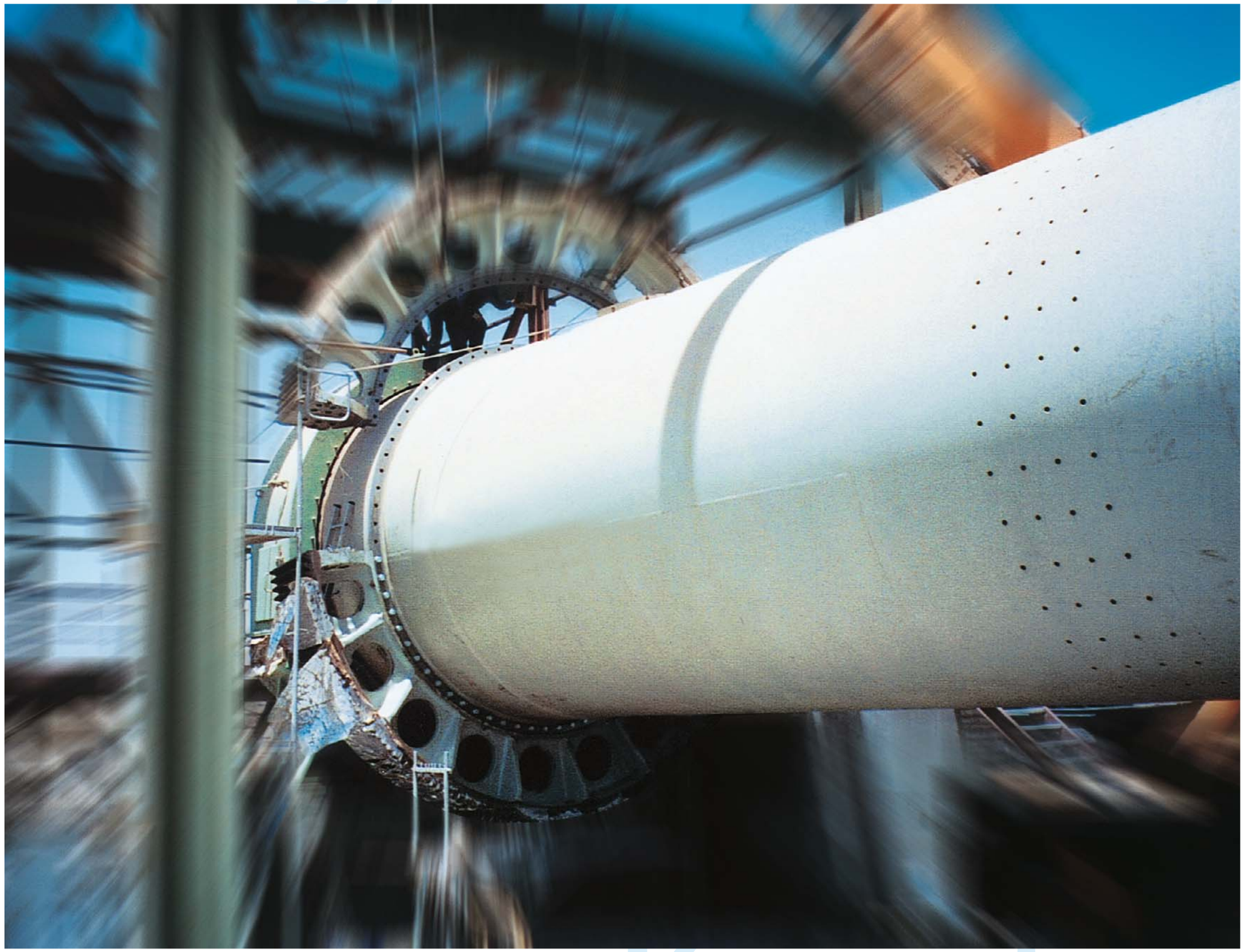
Technology

Don't settle for just any solution. Accept only the best.

Nobody knows better than you that the grinding of raw material requires a lot of energy - more than any other production steps in the raw material industry. A solution to this problem is the highest challenge for us all.

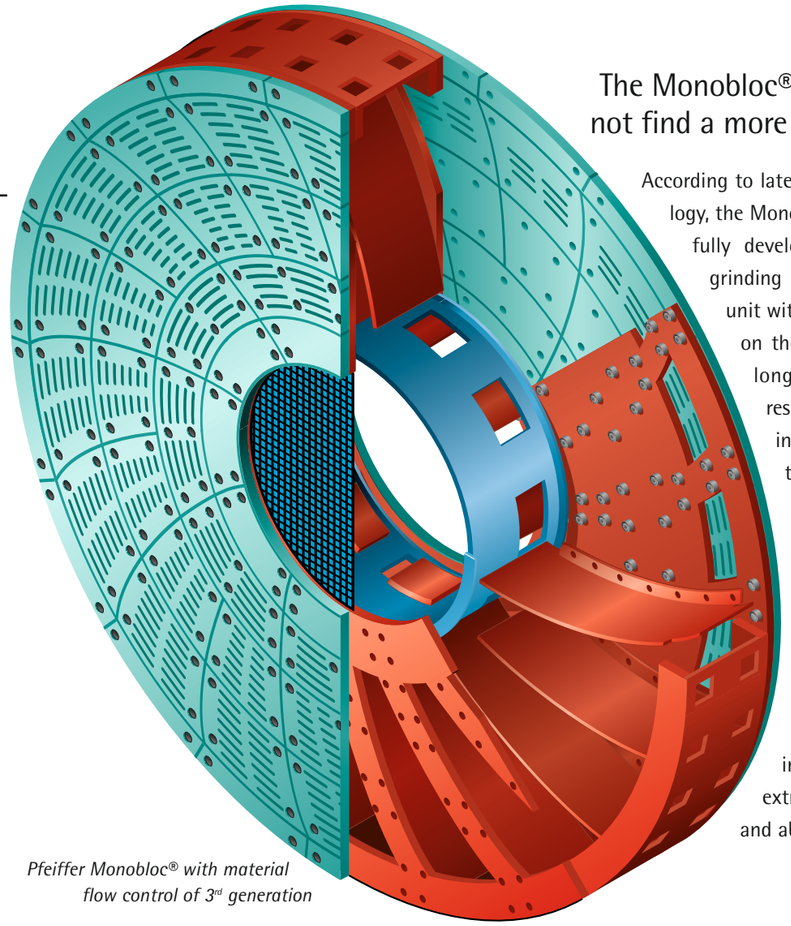
Christian Pfeiffer has brought changes to the market for grinding systems for decades with innovations to increase performance capacities, decrease energy consumption and improve product quality and further developments for greater productivity. Our concepts have made us the technological market leader we are today.

Granted, you may receive offers for products that seem cheaper, however, not all of those offered products pay off for you in the end. Our solutions do. Every day and for many years.



Know-how

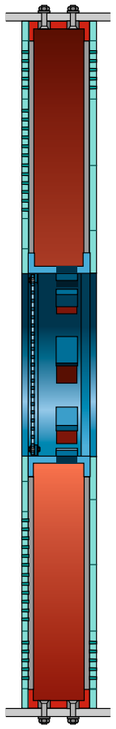
Monobloc®



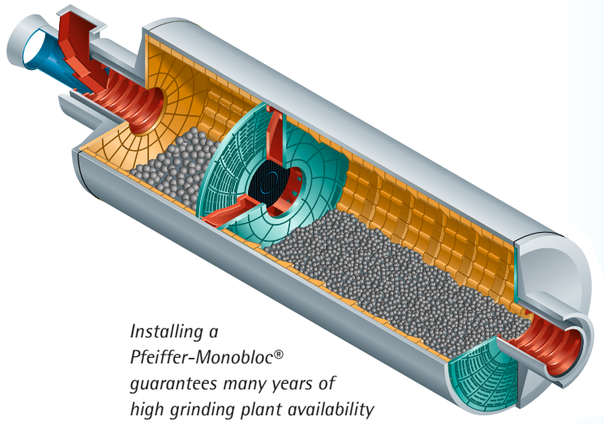
Pfeiffer Monobloc® with material flow control of 3rd generation

The Monobloc® structure: You will not find a more intelligent concept

According to latest developments in technology, the Monobloc® structure is the most fully developed solution for modern grinding systems: A self-supporting unit with a U-ring for axial fixation on the mill tube - highly stable, long lasting, and especially resilient. Other essential parts include the transport lifters that are curved in material conveying direction, a diaphragm centre with integrated material flow control, slotted plates designed for the highest productivity, and the solid plate cross for support. All in all, the best you can have in a grinding system under extreme thermal, mechanical, and abrasive conditions.



Monobloc®



Installing a Pfeiffer-Monobloc® guarantees many years of high grinding plant availability and continuous finish material quality.

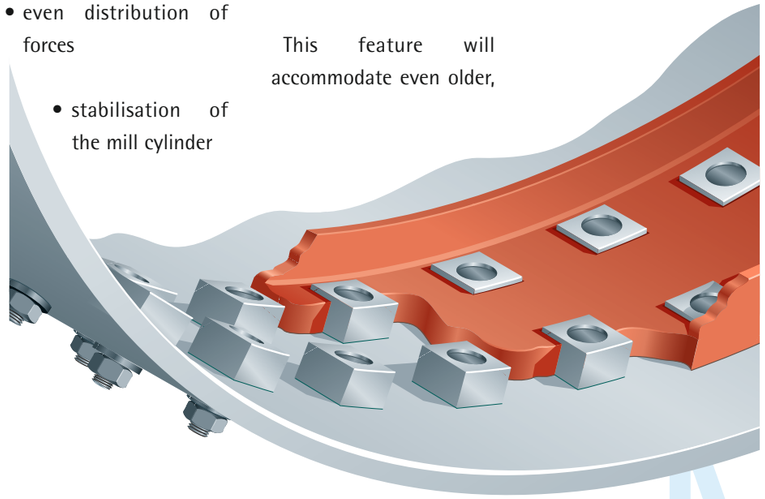
Ideal hold by "Floating Fixation"

Floating fixation is a feature you can only find with Christian Pfeiffer. This design limits load transmission variables which allow the interactive load influences between diaphragm structure and mill cylinder to be calculable. It therefore demonstrates the following advantages in comparison with other types of fastening:

- noticeably less tension between diaphragm structure and mill cylinder
- no relative movements and deformations inside the diaphragm structure
- even distribution of forces
- stabilisation of the mill cylinder

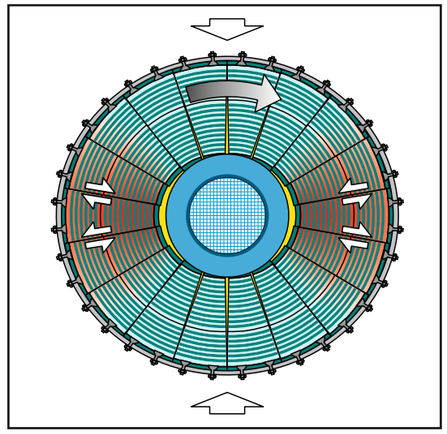
Floating fixation ensures a longer lifetime of the mill cylinder, mill diaphragm, and related parts.

This feature will accommodate even older, oval-shaped mill cylinders making the installation of a Christian Pfeiffer diaphragm, with its precise fitting, possible.

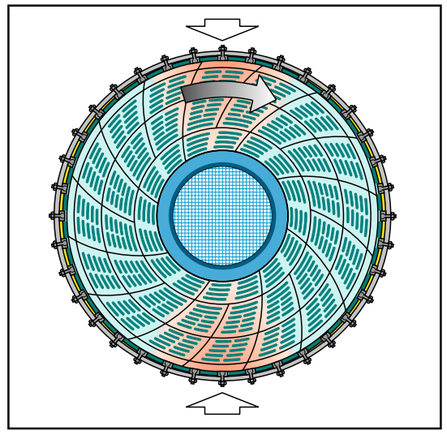


Reliable stabilisation by closed construction

The stable construction of a Monobloc® substructure supports the mill cylinder and prevents large deviations of the ideal round mill shell form resulting from loads of up to 300 mt of ball charge. The Christian Pfeiffer intermediate diaphragm counteracts such deformation and therefore decreases dynamic material strain of the mill shell.



Intermediate diaphragm in segmented construction



Pfeiffer Monobloc®

Why should you decide on a Pfeiffer diaphragm?

Because you can rely on the fact that we continuously implement innovations of our own research and development into our products.

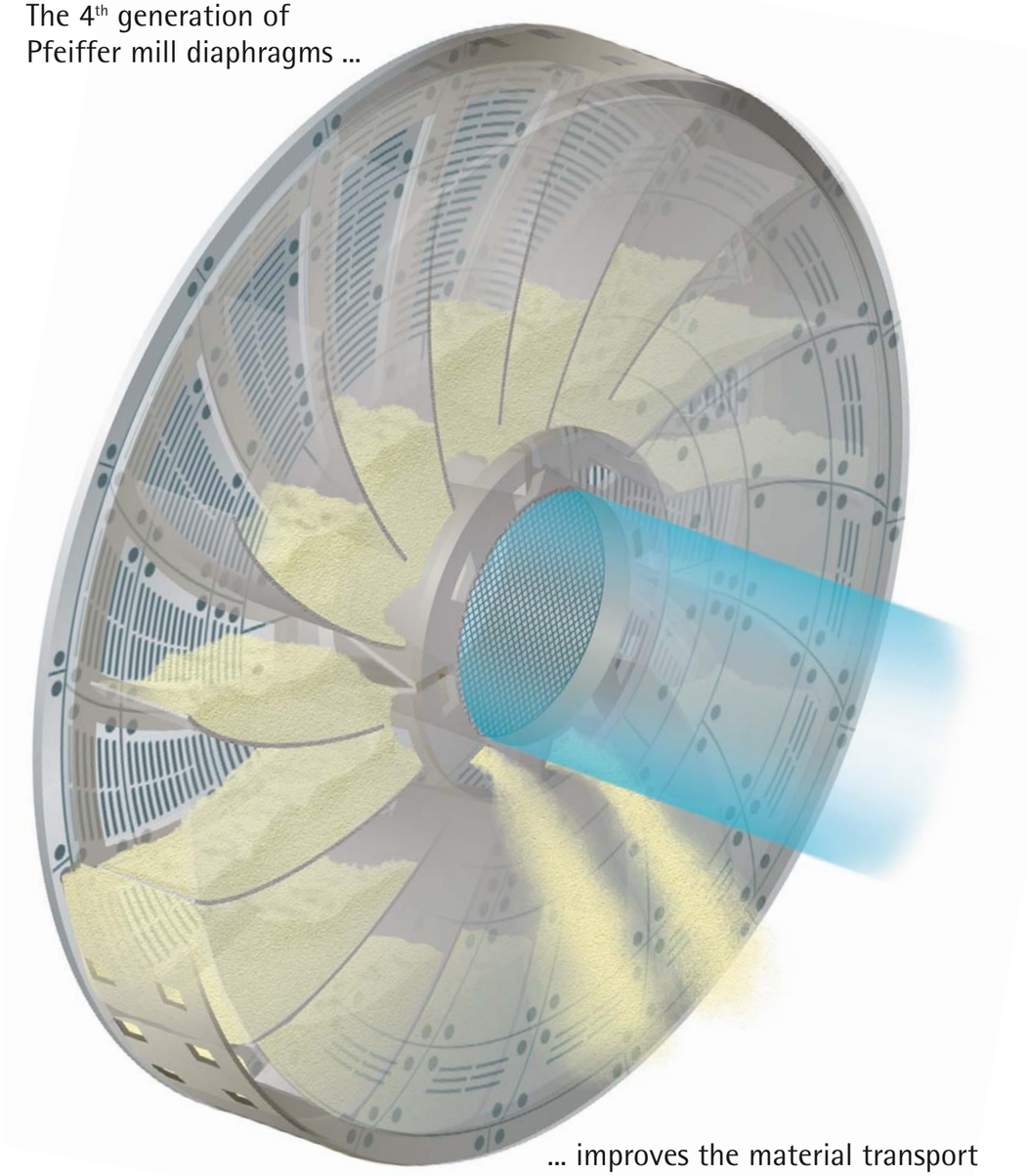
Naturally for our wealth of experience and know-how gained from the long tradition of our company in the industry.

Or simply because we have installed more than 5,000 mill diaphragms in grinding systems of renowned cement manufacturers world-wide!

Monobloc

4th Generation

The 4th generation of Pfeiffer mill diaphragms ...



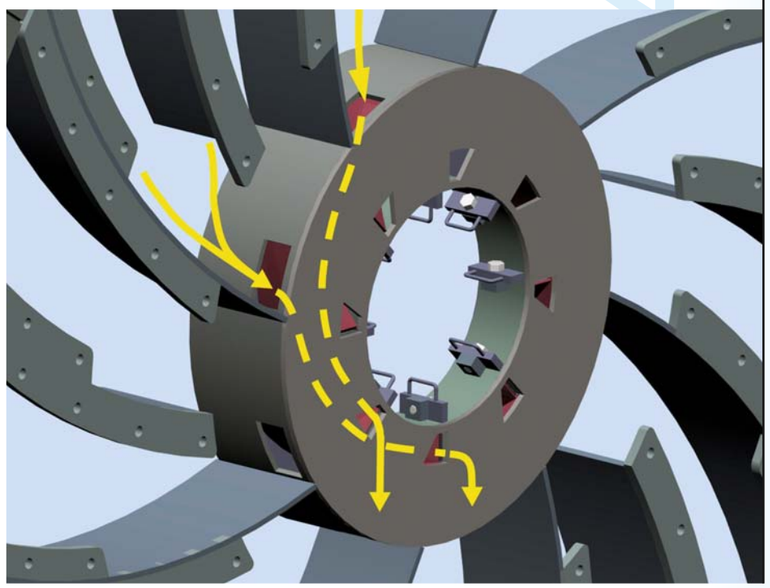
... improves the material transport

For the first time, a new diaphragm construction has been developed which separates material flow and air flow from each other; both components now follow their defined path and do no longer mix.

Through transport lifters in the diaphragm, material passes by inlet openings in the central ring channel where defined guiding lifters convey the material beneath the air flow into the next grinding chamber. An entry of the grinding material into the air flow is not further possible. Material reaches the ball charge directly behind the diaphragm which assures an optimal use of the chamber length and a most efficient grinding process.

At the same time, wear at grinding balls and backside plates is considerably reduced.

The material flow can be adjusted by regulable inlet and outlet openings. The adjustable opening cross-sections allow the best possible basic mill setting and guarantee a long and economical operation of the grinding plant.



Material flow inside the ring channel of the diaphragm

Milestones of development

Since 1925, again and again Christian Pfeiffer has set milestones in the development of machines, components and systems for the cement, raw material and mining industry.

The cooperation with technical colleges, own research and development as well as the exact knowledge of all process steps have made Christian Pfeiffer one of the leading suppliers world-wide for the realisation of modern grinding plants.

The fabrication of the first HEYD separator in 1948, the development of the high performance separator QDK in 1987 and now in 2003, the introduction of mill diaphragms of 4th generation into the market is proof of the excellent reputation of Christian Pfeiffer. With this new development, we have made another decisive step to improve mill efficiency.

Customers from all over the world rely on the innovations from Christian Pfeiffer Beckum.

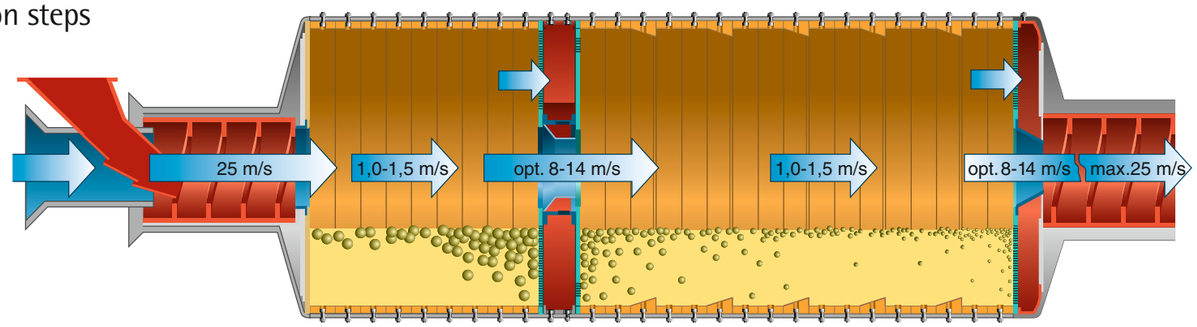
Process Technology

Comprehensive process know-how for all comminution steps

For all applications in the cement and raw material grinding process, CPB offers the full range of mill diaphragms. With more than 75 years of experience, we control the entire process technological know-how for all comminution processes including the safe handling of high temperatures in preceding drying chambers.

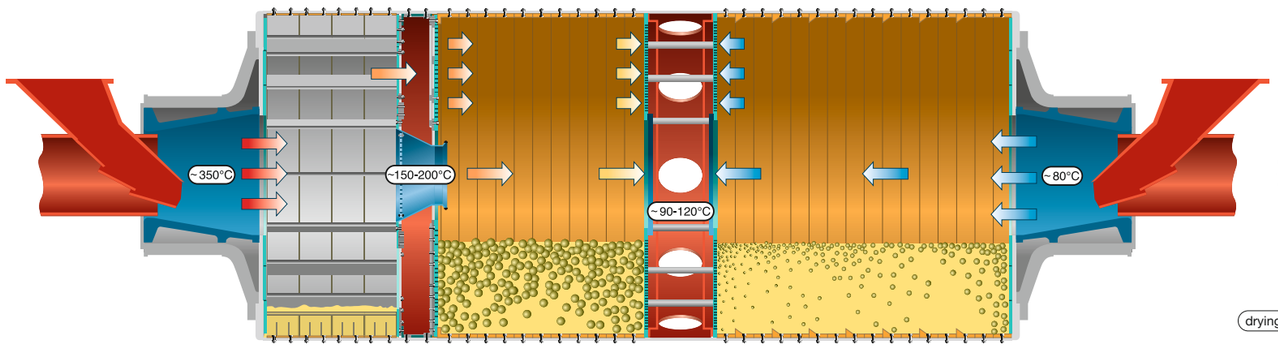
Our machines and components are successfully used all over the world for grinding of limestone, ores, coal, alumina, feldspar or other basic materials. CPB presents solutions also for abrasive raw materials with high quartz content, for example, to ensure a safe mill operation.

Christian Pfeiffer succeeded in tripling the free area of air passage in the centre of a diaphragm without negative effects to the stability of the entire structure. Pressure loss in the mill cylinder is decreased automatically.



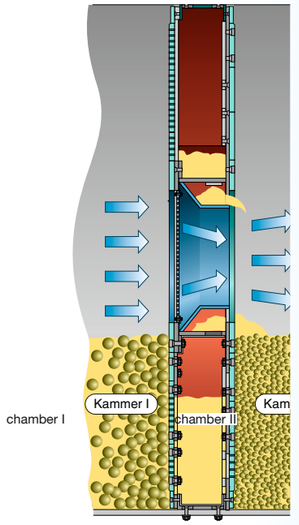
Two-chamber cement mill

The integrated material flow control system with directly accessible slides and the material passage outside the air flow assure an even material level in both chambers, in front and behind the diaphragm. This is why a safe and stable mill operation at optimal efficiency is guaranteed.

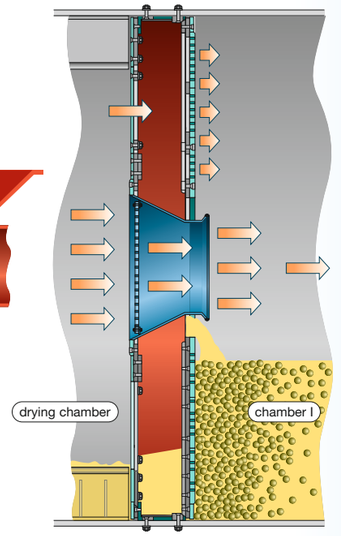


Raw mill with drying chamber and central discharge

Material drying to the optimal residual moisture is effected in the preceding drying chamber. Then, the material is regularly conveyed through the open lifter diaphragm into the first grinding chamber. Due to our special construction solutions we are able to control the high thermal loads in this area.



Intermediate diaphragm of 4th generation



Open lifter diaphragm of 4th generation

Solutions to suit you ... tailor-made!

Each mill is different. Therefore, we adapt our mill diaphragm construction and process technology individually to your grinding system.

The integrated material flow control of the mill diaphragm is adjusted as a final step to correspond with your specific grinding requirements. Infinitely adjustable slides in the diaphragm centre are set to offer the best conditions for optimal productivity and quality.

Conventional diaphragm (competitor) leads to an insufficient material level. Hence: inefficient grinding and high wear.

Technology

Diaphragm Lining

Better handling due to lighter plate elements

All Christian Pfeiffer mill diaphragms are fitted with slotted and backside plates of rolled steel. Advantages over cast plates: The material is breakage resistant and guarantees a high operational safety over the entire lifetime due to a homogeneous structure and special heat treatment.

The plates are smaller, lighter, and hence the assembly is easier compared to plates of segment construction.

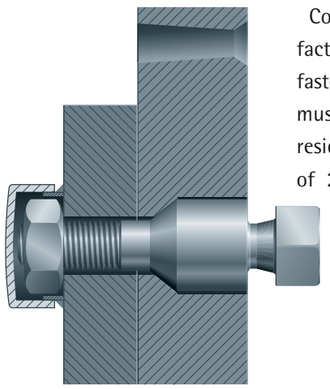
The mill diaphragm can be adapted individually to each ball volume load due to its variable centre.

Consistent material flow due to our special slot form

Typical for Christian Pfeiffer mill diaphragms: Plate slots which are adapted in width to each application and also carefully reduced in their conical form.
Only sufficiently ground material reaches the second grinding chamber.

Further, clogging is prevented and the slot form ensures that transfer conditions from the first into the second grinding chamber remain nearly constant during the entire period of use.

Higher plate use by conical bolt design



Conventionally manufactured cast plates are fastened with bolts that must be replaced at a residual plate thickness of 20 mm due to their cylindrical form.

Christian Pfeiffer's solution: Bolt fastening with a conical design. This form prevents early failure of bolt connections and allows efficient use of plates up to a residual thickness of 8 - 10 mm.

Another interesting detail from CPB are the nut holders for wear plate fixation. The holders are welded on the inner side of the substructure allowing the assembly staff to fasten the plates quickly and easily.

Cost and material savings by ring segments

To increase efficiency of the diaphragm lining, we developed a slotted plate construction, which depending on mill diameter, is divided into two to four rings. The plate rings can be adapted to isolate the area of greatest wear according to experience. Therefore you do not replace the entire lining but only those plate rings that have the greatest wear.

Lifter plates reduce the friction wear between ball charge and diaphragm and therefore assure a longer lifetime of the diaphragm lining.

This material is really tough

Christian Pfeiffer has further optimised the special rolled steel material for the lining of mill diaphragms once again:

Heat treatment over several steps develops a rolled steel with a martensitic structure which, due to its high elasticity, ensures reliable breakage resistance and a hardness of more than 52 HRc.

Your advantage: extraordinary efficiency due to long lifetimes.

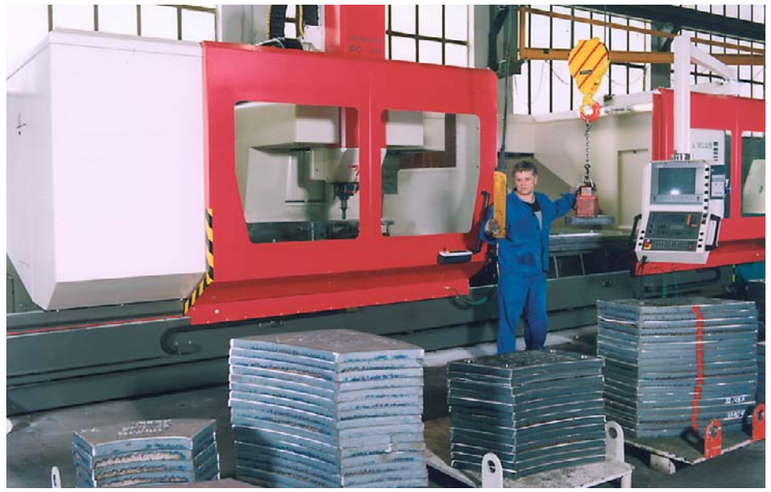
phragm Lining

Modern Production

Plate production with CNC-controlled machines

At CPB, all components of a mill diaphragm are manufactured with the most modern machinery. The fabrication is efficient and accurate using CAD/CAM.

The plate blanks are precisely manufactured to size on the CNC machines which guarantees highest quality and smallest tolerances. In a next step, the bolt swages are manufactured in one clamping; this ensures an optimal fitting of the plates on the diaphragm structure. The machining of the surface profile for lifter plates is done in a secondary working step.



Modern CNC machine

The components for the mill structure are also manufactured on the CNC machines. This ensures high accuracy and finally short assembly times in the mill.

Precise plate manufacture at Christian Pfeiffer in Beckum

Precise works for all production steps

The conically designed plate slots are cut by robots; the groove in the slot area is precisely machined.

Highly wear resistant plates through multiple heat-treatment

At the heart of the production process at Christian Pfeiffer is one of the most modern heat treatment plants in Europe. Through the multiple heat treatment process, the diaphragm plates are hardened for high wear resistance. The plants' control system assures a precise temperature regulation during all heat treatment steps. Heating, cooling down and tempering of the plates form a material structure with a homogenous and non-warping matrix.

Your investment in a CPB mill diaphragm is the decision for a safe and long-lasting stable operation of your grinding plant.

At Christian Pfeiffer, all production steps are documented acc. to ISO 9001. Protocols regarding dimensional and accuracy controls as well as hardness testing are always available.

For several years, CPB is internationally certified and herewith ensures a continuously high quality in all production steps.

One of the most modern heat-treatment plants in Europe

CAD/CAM for safe production

All production steps at Christian Pfeiffer are CAD/CAM-controlled with the following advantages: safe production process, high product quality and economical productivity.

Standardised components or individually designed parts according to customer requirement - all is possible. But what always remains the same: the entire CPB know-how influences the construction and production. Each project is calculated with most modern 3D-CAD units and is constructed as economically as possible. Accurate technical data is furnished directly to the production department.

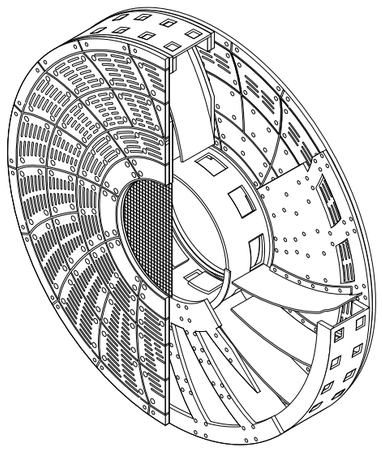
Production

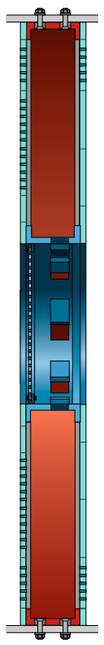
Diaphragm

Types and Services

The Intermediate Diaphragm

Optimal efficiency for existing grinding systems: The Christian Pfeiffer Intermediate Diaphragm fulfils the most important condition for an increase in mill efficiency. It divides the tube mill into two grinding chambers with different grinding ball sizes and maintains a material level in the first chamber for optimal pre-grinding. Additional safety is created limiting the largest grain size by allowing only the fine material to pass. This way the material to be ground is crushed in energy-saving manner in two steps: first it is crushed, then it is ground fine.

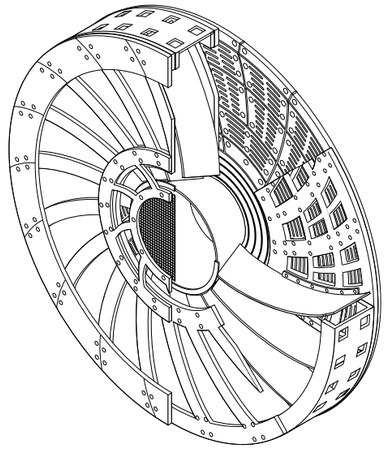


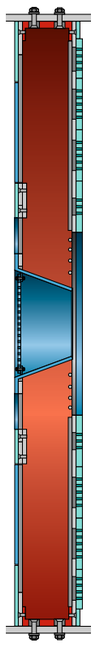


The Open Lifter Diaphragm

Designed to withstand every strain: The open lifter diaphragm is installed between the drying and the first grinding chamber. It is prone to high thermal strain from one side and to large axial pressure from the other. Christian Pfeiffer offers you the best technical solution for such a problem area: Steel types matched for their thermal and mechanical properties result in an open lifter diaphragm best fitted for these conditions.

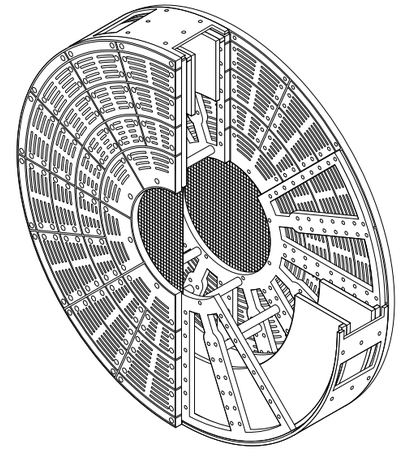
In addition, special fastening elements are used to safely absorb the high axial forces.

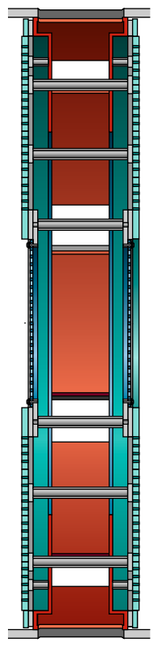




The Double Outlet Diaphragm

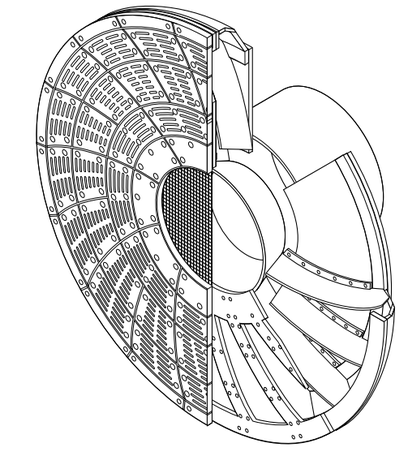
Perfect in centre discharge mill where pressure comes from two sides: The Christian Pfeiffer Double Outlet Diaphragm allows the material ground to pass from both head sides of the mill through the centre of the mill length. The special retention rings ensure sufficient material load in each of the grinding chambers. As with all Christian Pfeiffer diaphragms, the plate division in two to four rings pays off because such division allows for the exchange of only the linings within the main wear zone possible.

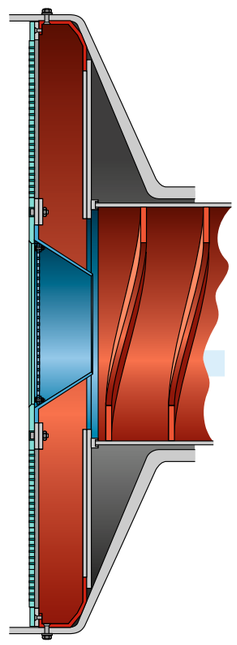




The Discharge Diaphragm

Only sufficiently fine material passes:
The Christian Pfeiffer Discharge Diaphragm is individually adapted to the existing mill and fixed on the inside of the mill head. The ground material is permitted to pass to the separator while the grinding balls are retained in the chamber. Thanks to the exchangeable centre piece, the open centre of the diaphragm can be adapted to the individual ball filling rate (volume load can vary between 25 % and 35 %).





Services

PFEIFFER has many advantages to offer in addition to our products

One advantage is our comprehensive service.

From individual recommendations, detailed planning, up to reliable installations. Even afterwards, we are there for you if questions arise, or if you require anything, and naturally for maintenance and inspection.

If you would like to have more information on our products and services... Call us. It will be a pleasure for us to assist you.