LATEST TECHNOLOGICAL INNOVATIONS IN GRINDING WITH THE VERTICAL ROLLER MILL

NEUESTE TECHNOLOGISCHE ENTWICKLUNGEN BEI VERTIKAL-ROLLENMÜHLEN
SUMMARY

Without any doubt, today’s grinding plants have to feature highly efficient mills with high efficiency classifiers showing low specific energy consumption and the highest possible mechanical durability. However, that alone is not sufficient to create the highest conceivable standard. Concepts are required which are not only aimed at certain parts of a grinding plant and its process but which are part of a comprehensive approach to creating competitive projects. This can only be done by keeping the main goals in mind, which are low TCO-values, as little as possible environmental impact and the highest safety standards. Any design detail of a grinding unit should follow this philosophy. With the innovative COPE drive and the “4+4” cement mills and 6-roller raw mills in combination with a common parts concept covering both of the mill types, the technical and commercial risks derived from single grinding unit solutions are significantly reduced. Unexpected and undesirable down-time of the grinding plant is avoided by built-in redundancy and an optimized spares management. By employing the compact plant design which can be adapted to the respective project specifics, the CAPEX of an installation is significantly reduced whilst improving on process features at the same time. Supplementary to this, the LM-Master control system increases the availability of the grinding plant at high capacity levels and maintains a constant product quality. Many other issues, such as plant flexibility, separate versus intergrinding or variable speed versus fixed speed etc., can be raised and also controversially discussed with respect to their purpose in contributing to the “ideal” grinding plant. In any case, clever solutions are of an individual nature aligned with the requirements of the project and those of the cement market.

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(English text supplied by the author)
1 Introduction

The cement market is constantly evolving and many factors do have an impact on this. Fluctuating energy prices, cement demand, mergers, political, economic and environmental set-ups – many of them global phenomena – result in scenarios which eventually define the regional and local cement market with all its facets and prospects. As part of this system, product development in the field of grinding technology needs not only to follow trends but also to predict future developments and to lead the way, offering solutions which are not even visible on the horizon today.

Basically, the feasibility of a certain technology and a related project is based upon a multitude of circumstances. More specifically, a lot is about key indicators such as TCO, CAPEX and OPEX which have always been of crucial importance. But further to that, environmental considerations have gained ground and depending on the region may have a greater effect. Water is a scarce resource in some areas of the world and emission limits have become strict and more constraining to the industry. CO₂ is held to be responsible for global warming, leaving the cement industry in a slightly vulnerable situation with roughly 1 t of CO₂ emissions per tonne of cement. In general, producing a “green” product is beneficial even though that appears to be somewhat contradictory considering the cement production process. Definitely cement producers opt for more tailor-made products with reasons varying from more economically viable – including the reduction of CO₂ emissions – to application-related ones. Resulting from this, grinding technology in the cement industry needs to exhibit low CAPEX and OPEX values and at the same time consume as few resources as possible. Endeavoring to achieve this, it is obviously not sufficient to focus on a single section of a grinding plant; probably it is not even enough to focus solely on the technology. A state-of-the-art grinding unit combines all the differing contributory aspects, such as a highly efficient mill, a perfect plant layout, a proper maintenance and spares concept as well as a modern control system.

2 Modern state-of-the-art grinding plant

2.1 Large units

One of the trends coming with large cement kilns – the largest is in the range of 13000 tpd – is the demand for large cement, raw and coal mills. The basic question that needs to be answered during the project stage is whether to implement one or two grinding units for the raw material, the cement or for coal. Playing it safe, one would rather decide in favor of two mills instead of one but after taking the investment costs – about 20 to 30 % higher for two units – the maintenance costs and the staff requirements – less for one unit – into consideration, there are many arguments in favor of one single mill. What is of the greatest concern? High on the list is the availability of the grinding plant which is not necessarily meant in the sense of an average availability. This is usually dominated by the material handling rather than the main equipment. It is basically the fear of experiencing a catastrophic failure with a long period of down-time, in the worst case (e.g. raw mill) of the entire kiln system. As a result, large grinding units need to demonstrate as much in-built safety and redundancy as possible. This is in particular with respect to the long-lead or expensive stock items. Amongst others these involve the mill drive and the roller/hadraulic system.
Loesche’s approach to this situation are the 6-roller raw (e.g. LM 69.6) (Fig. 1) and the 4-roller coal mills (e.g. LM 43.4 D) both of which have been on the market since 2006. Since 2014 the (4+4)-roller cement mills have completed the cement mill product range. The Loesche MILL LM 70.4+4 CS (Fig. 2) has been sold to a cement producer in Nigeria and will be put into operation in 2016.

Today Loesche raw mills as well as the cement mills are available with the COPE (Compact Planetary Electric) drive which has been jointly developed by RENK AG and Loesche GmbH to ensure the utmost reliability and redundancy. The COPE drive system (Fig. 3) is a 2-stage multi-drive-type gear box with up to 8 individual drive units and a combined installed power of up to 13 MW. The vertically installed electrical motors connect to the gear box by means of helical gears, thus rendering the formerly (for large units) critical bevel stage obsolete. The second stage consists of a typical planetary gear. The mill and the drive are able to operate even, if half of the drive units should fail. The gear box can be installed with or without a frequency converter, whichever is more appropriate with respect to the number of cement qualities and the range of finenesses to be ground.

Additional in-built redundancy is provided by the 6-roller system (raw mills) and the (4+4)-system (cement mills) comprising four master rollers to do the grinding and four support rollers for grinding bed preparation. The machines are equipped with independent hydraulic systems which allow for the swinging out of two of the rollers whilst remaining in operation with four rollers (raw mill) or two rollers (coal or cement mill), the remaining capacities being 80 and 60 %, respectively. Cement and raw mills share many common parts which has a positive impact on the spare part management of a plant. The gear box as well as the roller modules roller with tire, rocker arm and hydro-pneumatic spring system are kept equal for various combinations of raw and cement mills (Figs. 4a and 4b). These are suitable for all typical cement production line capacities, also when taking different raw material physical properties into consideration.

2.2 LDC classifier
The inherent design of a vertical roller mill includes classifiers which are integrated into the machine leading to a variety of positive aspects of the grinding system such as a compact self-supporting structure, high capacity, low specific energy consumption and an excellent drying capability.
advantages of the latest classifier design can be applied without changing any of the interfaces, e.g. the duct to the filter/cyclone, the connection to the feed inlet chute and the flange to the mill.

3 Compact plant design

Since the overall investment for a grinding plant is not only defined by the mill itself but rather by the entire grinding plant including the civil, mechanical and electrical engineering as well as the construction, great efforts are made to optimize all of these to save costs and time. The compact plant design (Figs. 7 and 8) represents a stripped-down-to-the-minimum plant combining a small footprint, a low building height and a minimum of steel structure together with excellent process efficiency and proper maintenance concepts.

For any new grinding unit the basic compact plant design is adapted to the actual projects specifics. The environmental conditions play a role in the same way as the question of whether the project is a green-field, brown-field, stand-alone or an integrated unit. Is there a need for a building? Where is the product silo located? Are mobile maintenance cranes available? How much space is allocated to the feeding system? Those factors require thorough consideration, always targeting low CAPEX values and short erection times which may well positively influence the total project realization time.

Bearing that in mind, Loesche re-designed its LSKS classifier in 2008 and the LDC classifier (Fig. 5), which represents the latest generation of dynamic classifier development, was introduced to the market in 2009. Compared to the former LSKS, the LDC exhibits enhanced process and mechanical features of which the patented Vortex Rectifier is the most prominent.

By the beginning of 2015 some 35 classifiers of this type have been put into operation in combination with different mills for raw material, slag and cement grinding.

The comparison of delta p-values over the classifier for the old and the new design shows a consistently reduced pressure drop for the LDC (Fig. 6). In terms of product quality the particle size distribution (PSD) is in the same range as before with slopes of n = 0.90 to 1.05.

For the purpose of retrofitting existing LSKS classifiers, the LDC classifier comes in its LSVS-version adapted to the geometrical situation in the respective grinding plant. Thus the...
Loesche – worldwide presence

Loesche is an export-oriented company run by the owner, which was established in 1906 in Berlin. Today the company is internationally active with subsidiaries, representatives and agencies worldwide.

Our engineers are constantly developing new ideas and individual concepts for grinding technologies and preparation processes for the benefit of our customers. Their competence is mainly due to our worldwide information management. This ensures that current knowledge and developments can also be used immediately for our own projects.

The services of our subsidiaries and agencies are of key importance for analysis, processing and solving specific project problems for our customers.

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