L.B. Bohle
Maschinen + Verfahren GmbH

Press Information
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L.B. Bohle rejuvenates management team

Inauguration of the Technology Center:
Continuous production on its way to practical application

- Official inauguration of the Technology Center in Ennigerloh with trade congress
- Special machine builder L.B. Bohle Maschinen + Verfahren GmbH offers international experts a platform for the advancement of continuous production
- Tim Remmert (Sales), Thorsten Wesselmann (Technology) and Dr. Hubertus Rehbaum (Research & development) promoted to the management team

Frankfurt/Ennigerloh, June 2015 – L.B. Bohle Maschinen + Verfahren GmbH has taken advantage of the 2014 business year to prepare itself for the future with investments of several millions. The newly built Technology Center at the Ennigerloh headquarters was inaugurated in March 2015. “Together with customers, partners and scientists, we can now draw on an ideal development platform to achieve a breakthrough in continuous production and push forward its practical application,” said Lorenz Bohle. Moreover, the owner of the company has rejuvenated the management team at the beginning of the year. Sales Manager Tim Remmert was promoted to the management board. Dr. Hubertus Rehbaum (Research & Development) and Thorsten Wesselmann (Technical Operation) will be more closely involved in the management.
Leading position defended

"We have defended our leading position in the 2014 business year and made further investments in innovations," said Lorenz Bohle. The gradual development of lean production in Plant 3 has made further progress. Therefore we have achieved further optimization of the production processes within a very short period of time. Faster delivery is leveraged as a competitive edge in the sales offensive. "We are striving to achieve double-digit growth in the current business year and have already generated a large proportion of the envisaged order intake," commented Lorenz Bohle with optimism. The contacts established at ACHEMA are to provide further impetus.

Platform for knowledge transfer

At the Bohle Technology Center, customers, scientists and cooperation partners can draw on an ideal platform for the advancement of continuous production processes. In the high-tech building with impressive architecture, solutions for direct compression, wet granulation and dry compacting are presented. "Permanent measuring, monitoring and control of the production throughout the entire process is decisive for the customers," explained Lorenz Bohle. According to Lorenz Bohle, there still is vast potential in the development of innovative continuous production processes.

Personnel changes

The owner of the company has also set the course for future growth through personnel changes. "Our long-standing Sales Manager Tim Remmert joined the management board in early
2015 and is going to assume additional responsibility for strategic
tasks," explained Lorenz Bohle. Moreover, the Manager Scientific
Operations, Dr. Hubertus Rehbaum, was promoted to the
management team as Assistant Managing Director. Thorsten
Wesselmann has taken on the position of Head of Technical
Operation.

Focus on growth

The financial situation of L.B. Bohle Maschinen + Verfahren
GmbH remained sound in 2014. "We have maintained our equity
ratio of about 50 percent," Lorenz Bohle reported. Investments
are financed through ongoing business activities. "With a sales
offensive, the rejuvenated management team and potential
cooperation partners, we are optimally prepared for 2015," said
Lorenz Bohle.

"The trade fair in Frankfurt will be a great opportunity to continue
the intensive exchange of opinions regarding continuous
production with our customers," explained Dr. Hubertus
Rehbaum. "The plant, which is one-of-a-kind worldwide,
underscores our position as a technological leader," commented
Lorenz Bohle, looking forward to the interesting discussions.
Premiere at ACHEMA 2015:

Closed loop control circuit along the entire process

The pilot plant for the first time combines all steps of continuous production

Frankfurt/Ennigerloh, June 2015 – For many years now, continuous processes in pharmaceutical production have been the focus of the special machine builders of L.B. Bohle Maschinen + Verfahren GmbH. With the ceremonial opening of the Technology Center, the engineers, scientists, pharmacists and IT developers for the first time closed the loop control circuit of a modular system along the entire process including production, sensor technology and controlling. This results in substantial time savings as far as production is concerned, explained Dr. Hubertus Rehbaum, Manager Scientific Operations; Small batches for the production of clinical samples – for clinical studies prior to the approval of new preparations – can be produced more rapidly. "And series production is set to start as soon as we have received FDA clearance. There is no need to develop, install and validate a new production line."

Two basic ideas are at the core of the successful development project: first of all, the best machines for the individual process steps must be optimally linked to each other, both physically and technically in terms of data. "We have leveraged our acknowledged premium quality in the areas of granulation and coating and, with the companies of Gericke AG and Korsch AG, have taken on board another two technology leaders for
continuous blending/dosing and tablet press technology," said the initiator Lorenz Bohle.

Secondly, the machines had to be equipped with state-of-the-art sensor and measurement technology and all data had to be integrated on a common platform via standardized interfaces. The software integration, in turn, forms the basis of permanent monitoring, controlling and documentation of the continuous production process. "Cutting-edge spectroscopy technologies such as NIR and Raman enable precise measurement and analysis as part of the individual production steps," explained the Manager Scientific Operations, Dr. Hubertus Rehbaum. Therefore, the leading experts in this field, Kaiser Optical Systems, Sentronic und Kraemer Elektronik, have been involved in the project. Another major challenge is to directly process the data generated and make it available for use. Together with the IT partners and scientists of the universities of Aachen, Düsseldorf and Graz, models had to be developed for the simulation of various processes and for the definition and automatic initiation of measures and interventions. "Together, we have developed the intelligence of the system, so to speak," said Dr. Rehbaum. This “evolution process” will continue in the future.

**Highly flexible plant**

At the Technology Center at the Bohle headquarters in Ennigerloh, customers from the pharmaceutical industry can now experience the benefits of continuous production at first hand. "The unique feature of this plant is that the tablet production can be implemented either without granulation or with dry or wet granulation in one system", explained Lorenz
Bohle. The modular concept of continuous production offers substantial time savings since it does not require any time-consuming analyses of the product samples between the process steps. Moreover, producers benefit from greater flexibility because the plant can be quickly converted to different products.

**Investments of more than two million euros**

EUR 2 million have been invested in the glass-fronted building alone. "In the next years, we will make available several million euros for the cooperation in order to push the issue of continuous production further ahead," announced the owner. "We encourage experts to come to Ennigerloh," commented Lorenz Bohle on the breakthrough of continuous production technologies in the pharmaceutical industry.

**Holistic approach as an advantage**

This chance was also identified by the partner from the University of Düsseldorf, Prof. Peter Kleinebudde: "Given our long-standing and trustful cooperation, it was only natural to join the project as a scientific partner for developing the continuous production line". The "holistic approach" of this new form of production is especially interesting. "The objective is to link the individual process steps and to ensure consistency with constant parameters. To this day, this could not be guaranteed by science", said Prof. Peter Kleinebudde.
Bohle BRC 25
Small dry granulator rounds off the range

Frankfurt/Ennigerloh, June 2015 – With the dry granulator Bohle BRC 25, L.B. Bohle Maschinen + Verfahren GmbH now presents the smaller version of the BRC 100, which was presented for the first time at "ACHEMA 2012" in Frankfurt. “We now have rounded off our comprehensive offer of granulation solutions”, explained Lorenz Bohle.

Easy handling, continuous production and a small footprint are the typical features with which Bohle now covers the comprehensive portfolio of wet and dry granulation.

The concept of the BRC: In the roller compactor, powder is processed to free-flowing granulates. The objective in the pharmaceutical industry is to achieve a granulate with defined density or porosity for subsequent tableting. The powder is fed in via a dosing unit, compacted between two rollers with gaps ranging from 1 to 6 mm and discharged as flakes. The impact on the rollers as well as the gap width are monitored sensorially. All data are integrated into a control circuit to continuously ensure optimum process parameters.

The chopper unit below the compact rollers processes flakes into granulates. The unit is equipped with a conical sieve with exchangeable sieve units to achieve different particle sizes.

Well equipped for customers’ requirements:
Simple control, easy cleaning and fewer edges, screws and angles - these are the essential features that already distinguished the BRC 100.
Especially the control of the pressing force via standard hydraulic systems constitutes a great problem, when the process is to comply with “hygienic design”. The electro-mechanical batch can solve this problem.

With the Bohle BRC 25, frequent adjustment of the axes as with traditional roller compactors is a thing of the past. The axes are mechanically stable so that elastic deformation is prevented. This eliminates the need for complete axes control. Moreover, the BRC 25 is low maintenance. Even when cleaning is required, only four screws must be removed. Bohle engineers also reduced the footprint. Further advantages of the BRC series are the identical roller geometry and control in both machines allowing for easy scale-up.

Lorenz Bohle: “We are now able to offer our customers machines and processes for all stages of the granulation process with our new BRC 25 – continuously with the proven Bohle quality”.
Bohle with broad range of products

Best-sellers and newcomers: Film coaters, blenders and the Bohle Uni Cone® technology

Frankfurt/Ennigerloh, June 2015. At ACHEMA, L.B. Bohle presents its extensive range of products for pharmaceutical solids production. In addition to the innovations, the focus will be on best-sellers such as the process and laboratory machines for batch production, such as coaters, granulators and blenders.

In the field of coaters, Bohle testifies to its technological edge with the Film Coater BFC 200. "With the BFC, the visitors can experience the many benefits of the high-end version of the coater series, which achieves 40 percent higher performance levels than traditional coaters," explained Sales Manager Tim Remmert. Moreover, the BFC 5 laboratory machine is presented in Frankfurt.

With is dry and wet granulation technologies, L.B. Bohle lives up to its name as the provider with the greatest range of granulation solutions. The VMA Vagumator®, which will be presented to the public in Frankfurt, is based on the single-pot-technology. Blending, granulating and drying can be performed with the machine.

"The Bohle Uni Cone BUC® fluid bed technology still possesses a great innovatory value," said Dr. Hubertus Rehbaum, Manager Scientific Operations. The alternative to the conventional Wurster process which was developed
and patented in 2013, is more efficient and coats even the smallest particles with the highest precision.

With the two blenders PM 1000 and LM 40, a lab-scale blender, Bohle also positions itself as a global market leader in its second field of expertise - blending technology.
Lean production and new sales stimuli

Lorenz Bohle is convinced:
"We still have vast potential"

Frankfurt/Ennigerloh, June 2015 The 2014 business year of L.B. Bohle Maschinen + Verfahren GmbH was characterized by investments in the new Technology Center and the step-by-step expansion of lean production. At the beginning of the year, company owner Lorenz Bohle also appointed the long-serving Sales Manager Tim Remmert to the Management Board and recruited the Head of Scientific Operation, Dr. Hubertus Rehbaum, to the management team. On the occasion of the company’s trade fair presentation at ACHEMA, the management looks back on the previous year and provides an outlook on the trends in the pharmaceutical industry.

How did 2014 turn out for L.B. Bohle Maschinen+ Verfahren GmbH? What do you expect from 2015?

Lorenz Bohle: Having generated a turnover of about 39 million Euros, we are quite satisfied with our performance in 2014. We were able to maintain the momentum gained in the second half of the year and made a strong start to 2015. Therefore, we are in a satisfactory order situation and expect double-digit growth in 2015.
Where does this optimism stem from given the uncertain economic situation in important EU countries and Eastern Europe, notably in Russia?

Bohle: We have already secured three quarters of our targeted turnover and hope that our presentation at ACHEMA will provide further impetus. Provided that decisions are taken quickly, the orders may still take effect in 2015.

Tim Remmert: Moreover, customer perception is changing as well. The customers no longer see us as a pure machine builder but increasingly appreciate us as a supplier of comprehensive solutions. We are able to correspond to complex customer requirements in a very flexible way and always offer individual service. This ability also puts us in a strong position among our competitors. For instance, we have won several major orders in the first half of the year which also serve as a reference in the important growing markets.

How do you assess the developments in the pharmaceutical industry both on an international scale and with view to individual sales regions?

Bohle: The pharmaceutical companies are well-positioned as a whole and there is strong propensity to invest. Our industry is generally less prone to economic trends. However, the Russian market is suffering from a devaluation of the ruble. Luckily, the currency has gained
some ground again. In the mid-term, we still see promising opportunities as the government attaches great importance to domestic production. Against this backdrop, a great number of producers count on our quality.

**Remmert:** In the US, our key export market, the challenge will be to maintain the high level of the past years. In order to achieve this and also perform successfully on other markets, we invest in in-depth training of our sales agents. For instance, the systems are becoming increasingly complex due to the continuous processes and new measurement technologies. This added value must be communicated to the customers more efficiently. To this end, we have selectively strengthened our sales team and will continue to do so in future.

**What part does the recently inaugurated Technology Center play in this context?**

**Dr. Hubertus Rehbaum:** We have created a platform that serves customers, scientists and ourselves to further promote continuous production in the overall process. After ten years of primarily theoretic research in the industry, we are now taking the next step with the pilot system and its practical implementation in the production process. We are already able to supply parts of the system - the tablet press and the high-speed coater – as an integrated solution.

**Remmert:** The intensive dialogue with all partners will also be continued at ACHEMA. Thanks to the scientists
involved, our insights can be incorporated in the design of future approval procedures which also enables us to accelerate the approval phases for the benefit of our customers.

**Dr. Rehbaum:** With its own Internet presence, the Technology Center also offers an additional information platform which we will use to continue the open dialogue.

**Bohle:** The development process is far from being completed. We have strengthened our internal software team in order to expedite further development steps. I believe that we will see "a light at the end of the tunnel" by the end of 2015. We are constantly striving to maintain and expand our technological edge.

**In Plant 3, you are also setting standards when it comes to your own production processes. What progress did you make in lean production? Are you planning to make further investments?**

**Bohle:** With more than ten million Euros, we have made significant investments in the Sassenberg Plant, the Technology Center and Plant 3. Now, we have to focus on making optimum use of the new capacities. Lean production cannot be introduced overnight. It is a process of several years and stages. We are on a very good course in this regard.
How high is the level of capacity utilization in the plants?

**Remmert:** In Sassenberg, we are already reaching our limits despite the expansion. The trick is to build and deliver more machines through optimized processes and flexibility between the production sites with our proven core workforce. Lean production enables us to produce more efficiently, maintain high quality and deliver faster. These are clear competitive advantages.

**Bohle:** And in the future, we will be able to make greater use of intermediate products manufactured by suppliers. Therefore, there is still vast potential for increasing capacity in all of the existing plants.

**What do you expect of your presentation at ACHEMA?**

**Bohle:** At the trade fair, the customers from the pharmaceutical industry are offered a very concise overview in Hall 3. In addition to our process and laboratory machines for batch production, we will also focus on continuous production of course. Although the pilot system will not be presented live on the spot, the large-screen presentation will hopefully give rise to a lot of interesting discussions.
Facts and figures

L.B. Bohle at a glance

Company: L.B. Bohle Maschinen + Verfahren GmbH

Locations: Ennigerloh Plant 1 and Plant 3 (production, administration), Plant 2 Sassenberg Plant (handling machines and mixers), Warminster (USA; sales/services), sales offices in Singapore and Goa (India)

Premises: currently approx. 20,000 sqm of production and operating area at the Ennigerloh headquarters; 2,900 sqm in Sassenberg, another 3,700 sqm of production area in Plant 3 in Ennigerloh.

Employees: approx. 205 in Ennigerloh, 25 in Sassenberg, 15 in the US (marketing and sales/services), 10 company sales representatives worldwide, another 40 sales partners

Product range: Special machines and handling systems for the pharmaceutical industry: coaters, granulators, compact units, compactors, weighing systems, grinding and sieving machines, blending systems, containment systems

Turnover in 2014: approx. € 39 million

Customers: Pharmaceutical companies and their subcontractors worldwide

Export rate: approx. 80 percent in total

Markets: In addition to the German domestic market (approx. 20 percent), predominantly USA (30 percent), Europe (25 percent), South America and Asia
Owner: The Bohle Family (100 percent)
CEO: Lorenz Bohle
L.B. Bohle – partner for the pharmaceutical industry for over 30 years

Product range of the technology leader continues to grow

1981  After many years as the head of engineering for special machines for a pharmaceutical company, Lorenz Bohle founded his own company in Ennigerloh/Westkirchen. He first developed the tablet checker KA. Today’s COO, Robert Stauvermann has been with the company right from the outset.

1983  Start of own production of L.B. Bohle Maschinen + Verfahren GmbH. Lifting columns and containers supplemented the supply range.

1986  Relocation of the company to Ennigerloh, the present headquarters. Decisive for the company’s growth is the system for dust-free penicillin production.

1987  First container blender sold, paving the way for the company’s continued growth. Since then, more than 3,000 PM container blenders ranging in sizes between 2 and 12,000 liters have been built and supplied to clients. Bohle is the global market leader in this segment.

1990  Foundation of L.B. Bohle Inc. (USA).

1991  L.B. Bohle lays the foundation for entry into process technology with the first single pot granulator (VMA). The first VMA already features microwave drying.

1998  L.B. Bohle extends its product range by coating technology with the first 70-kg-coater. The first coaters are still equipped with a drum replacement.

2000  Bohle launches the first 200-kg-coater with CIP equipment and a long cylindrical drum.

2000  Construction of the Sassenberg site

2003  With the tangential fluid bed process, Bohle laid the foundation for more compact systems.
2007 The company introduces the Bohle tablet coater BTC. The BTC provides unparalleled tablet consistency and efficiencies resulting in high speed, problem-free coating. Bohle’s airflow design within the coating pan reduces the likelihood of spray drying.

2009 Bohle presents the Conti Granulator BCG at ACHEMA in Frankfurt.

2010 Development of the continuous KOCO® coater.

2011 Start of construction work for the extension of the Sassenberg location; investment in the amount of € 3.0 million.

May 2011 L.B. presents the new coater generation KOCO®, the Bohle Conti Granulator BCG and the new compact unit at the Interpack.

October 2011 From now on, the entire handling production including construction is located in Sassenberg.

November 2011 L.B. Bohle acquires 20,000 sqm of developed land in Ennigerloh in order to double production capacity at the headquarters.

June 2012 The dry granulator Bohle BRC 100 is presented at ACHEMA 2012.

August 2013 The Bohle Uni Cone BUC® technology is protected as a utility model.

September 2013 L.B. L.B. Bohle inaugurates Plant 3. The 20,000 sqm premises encompass a production area of 3,700 sqm. The investment sum amounts to € 5 m.

May 2014 At the Interpack, the Bohle Uni Cone BUC®-® process and the BRC 25 is presented to industry professionals for the first time.

March 2015 Inauguration of the Bohle Technology Center in Ennigerloh with an international trade congress. In the pilot plant in modular design, the loop circuit along the entire process including production, sensor technology, analytics and controlling was closed for for the first time.
**Vita Lorenz Bohle**

**Lorenz Bohle**, CEO and owner of L.B. Bohle Maschinen + Verfahren GmbH.

After graduating from the Brilon secondary school, Lorenz Bohle (born 1939) completed an initial training as a machine fitter. Thereafter, he took up engineering studies in Kassel, at which time a “love of process engineering” developed in him - a relatively new science for improved production, which, at that time, was still in its infancy.

In 1972, Lorenz Bohle, now a qualified engineer, moved to Ennigerloh as technical manager of Rottendorf Pharma GmbH. There, he had a major impact on the establishment of clear process flows including the required documentation. Under his direction, the company received the GMP Good Manufacturing Practice Certificate for the quality assurance of its production processes relating to medications and active substances for both the existing and new facilities. The experiences he gathered then inspired him to found his own development and consultancy firm. In 1981, he took his first steps to self-employment.

In addition to his various professional activities, Lorenz Bohle is involved in numerous voluntary endeavors. He is a passionate hunter. Since 2007, he has been making his company’s training center available for regional art exhibitions, and sponsors a range of sports programmers in Ennigerloh. He has been a member of a successful men’s choir for many years.

Lorenz Bohle also backs a number of school projects and, within the framework of a cooperative venture with the Ennigerloh Secondary School, has established a metal workshop there. The company was honored for its “Obstgarten mit Park (Orchard with Park)” on the company grounds. In addition to this, the enterprise is the recipient of the Münsterland Innovation Prize.

Lorenz is married and has 2 children.
Selection of photos

Lorenz Bohle, CEO

Discussions between Lorenz Bohle, Tim Remmert and Dr. Hubertus Rehbaum
Tim Remmert, Sales Manager and Member of the Management Board

Dr. Hubertus Rehbaum, Manager Scientific Operations
Continuous production unit in the Technology Center

Technology Center at night