

# VDMA RESEARCH PROJECT LAYS FOUNDATIONS FOR SINGLE STAGE CONTAINER GLASS FORMING

Container glass such as bottles or jars for preserves is, at present, produced in a two-stage forming process. As part of a recent research project, the theoretical principles for a single-stage process have now been worked out. This process makes it possible to substantially decrease raw material and energy consumption. Instrumental to this project were German mechanical engineers and the Technical University Bergakademie Freiberg.

"If we want to remain competitive on the packaging market we have to make our glass thinner," says Dr. Ing. Michael Kellner, in charge of product

development at *Heye International GmbH*, a company specialized in manufacturing glass production lines. Heye International is part of the *Ardagh Group*, one of Europe's largest producers of container glass products employing some 6,500 staff. In addition to his job as a product developer, Kellner also heads the project *EinFormGlas* – a research project funded with EUR 2 million from Germany's Federal Government aimed at developing a single-stage forming process for hollow glass products.

## REDUCING GLASS WEIGHT

Some 50 to 60 per cent of the costs incurred in hollow glass

production are directly related to the weight of glass. And it was this key detail that also formed the basic idea for the research project according to Professor Hessenkemper.

Holding a chair of glass and enamel technology at the Technical University Bergakademie Freiberg, Hessenkemper initiated the *EinFormGlas* project. "If we want to bring down costs," he says, "we have to reduce the weight and increase the strength of glass."

However, this is only possible on an industrial scale to a very limited extent with the technology currently available. The reason for this is the two-stage forming processes used so far. In the first step of this process

## VDMA PROFILE

A recent research project resulted in a new forming process for container glass items using less raw material and energy. In this article, VDMA - (Verband Deutscher Maschinen- und Anlagenbau - German Engineering Federation) – outlines this work, ‘speaking’ to the people behind the project, from the commercial and institutional world.

the longitudinal, still molten glass drop is formed, either by mechanical or pneumatic means, into a so-called parison, which is then blown into a drinks bottle as a second step. An advantage of this process is that defects in the glass surface caused by the first forming step can be remedied. Since the glass walls are thick enough they store sufficient heat to melt cracks and scratches, especially on the surface, before the parison is blown into its final shape. But this only works as long as sufficient hot glass is available inside for re-heating. “If this is no longer the case,” explains Kellner “we are automatically left with a single-stage process.”

The VDMA (Verband Deutscher Maschinen- und Anlagenbau - German Engineering Federation) is one of the key association service providers in Europe and offers the largest engineering industry network in Europe. The VDMA represents 3,000 mainly small/medium size member companies in the engineering industry, making it one of the largest and most important industrial associations in Europe.

Mechanical engineering is a key technology and a powerful engine driving the economy. Accounting for sales of roughly EUR 160 billion and 920,000 employees, mechanical engineering is one of the largest industrial sectors and employers in Germany. The products and services of the engineering industry are highly regarded worldwide. Roughly two thirds of German production is exported.

The VDMA covers the entire process chain - everything from components and plant manufacturers, system suppliers and system integrators through to service providers. The organization reflects the varied customer-supplier relations all along the value adding chain, permitting both industry-specific and intra-industry cooperation.

The VDMA lends a powerful voice to the views of its members both at national and international level. Current focal points of representation work include:

- Labour market and pay policy/deregulation
- Education policy/attracting new generations
- Tax policy
- Research policy/technology policy
- Corporate financing
- Trade policy
- Environment and energy policy
- Trade fairs/trade fair policy

A network of well over 20,000 decision-makers and specialists from 3,000 member companies and 400 committed experts from the VDMA and its service companies ensure the quality of its services.

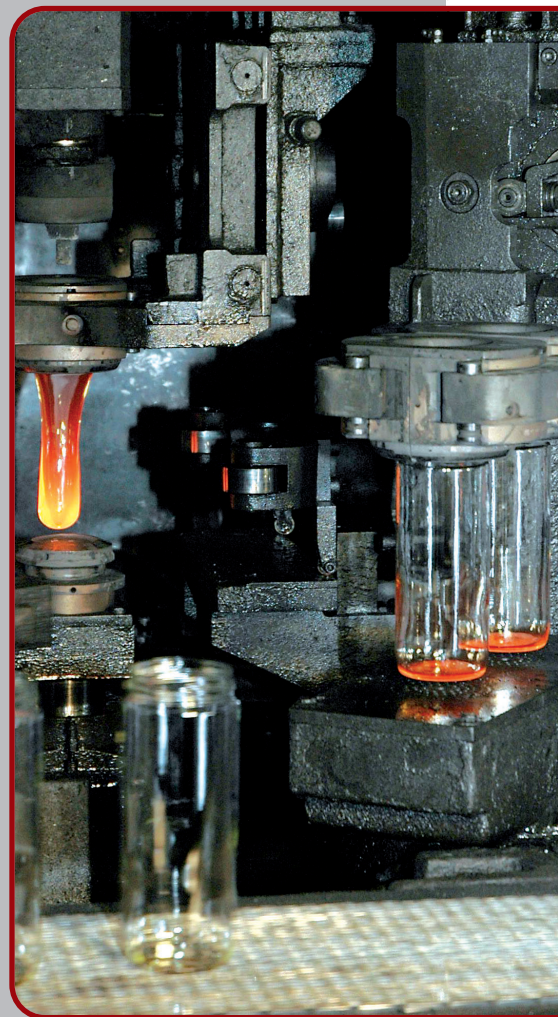
The spectrum covered is broad and is orientated towards the needs of the member companies.

Key areas are:

- Market, statistics and the economy
  - Foreign business and exports
  - Law, taxes and wages
  - Management and information systems
  - Marketing and customer service
  - E-Business and industry portals
  - Research and technical codes
  - Education and recruitment
  - Technology and the environment.
- Insurance services, target group-specific publications and an attractive range of seminars complete the profile.

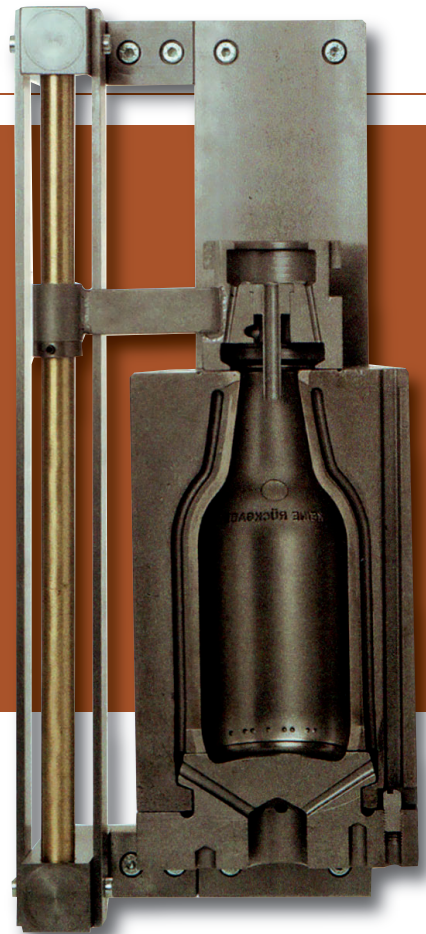
The VDMA brings together managers and directors, the department heads and specialists from the engineering industry.

The engineering industry is a multifaceted sector covering specialized, but also general areas. Regional associations, the broad spectrum of specialist associations, numerous research groups, committees and working groups all permit members to establish their own personal networks.



**The pictures shows a parison, which, in order to reach its final form, has to be transferred to the mould. Blown glasses can be seen in the foreground**

A set of moulds for narrow-neck extrusion-blow-technology: on the right hand side there is the pre-mould with the extrusion die, where the parison is made out of the drop; on the left hand side there is the mould into which the molten glass is blown to obtain its final shape



**OPTIMUM BATCH PREPARATION**

It is true that a wide variety of glass products are manufactured in a single-stage process. Since the damage does not ‘cure’ here, the surface strength of these products is far lower than with glass made in a two-stage process. An example is that of incandescent lamps, whose glass bulbs can quickly break even with minimal impact.

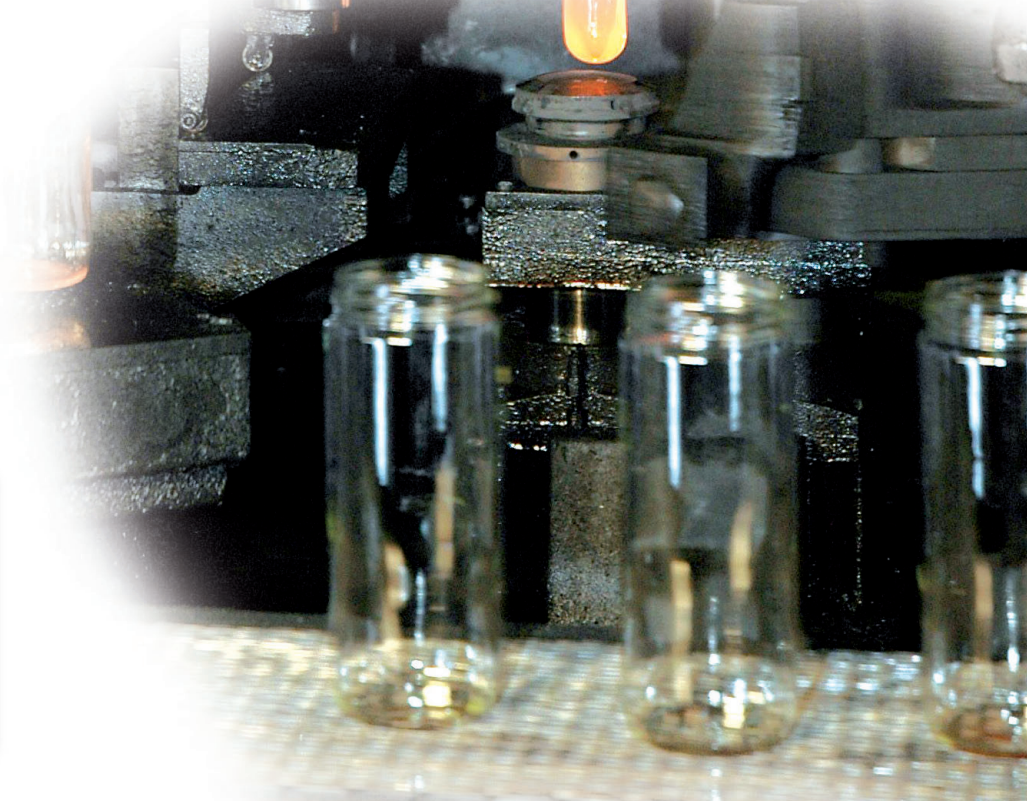
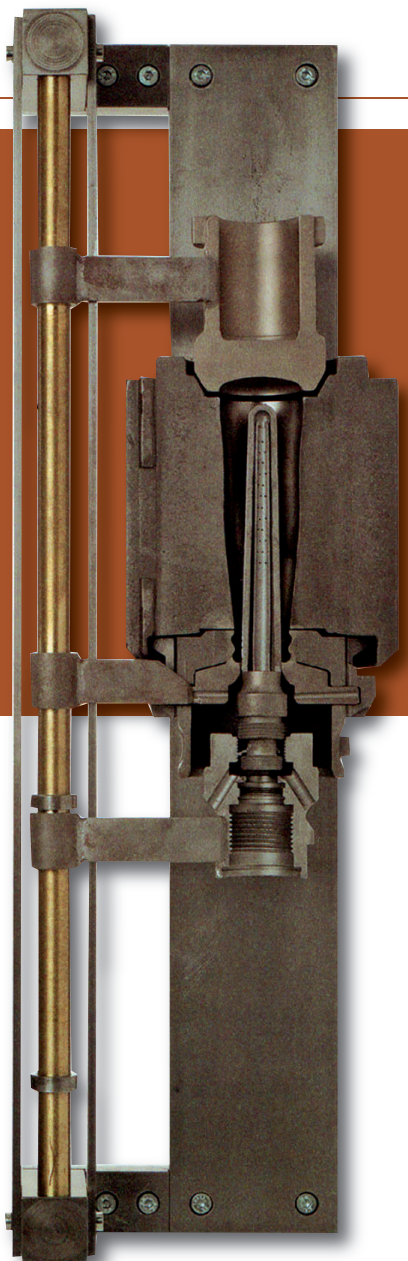
The project was designed to identify solutions that make the glass tougher overall specifically while keeping surface damage to a minimum. To this end, says Kellner, it was necessary to put not only the forming step but also the entire glass production process to the test. It was especially important to find the most ideal preparation of the batch later molten into glass in the tank. This needs to be as homogenous a mass as possible with an even spread of all components and, therefore, the quartz sand must ideally be compounded with the soda that acts as a melting accelerator. Furthermore, batch segregation, dust formation and sand accumulation in the tank must all be prevented.

The machine factory Gustav Eirich GmbH, an internationally recognized specialist in mixing technology involved in the project, solved this problem through

granulation, among other things. “Our new processes,” explains Harald Eirich in charge of the company’s glass division, “make for significant energy savings in the melting process.”

The machine manufacturer ran initial melting trials in his in-house lab in order to achieve the most optimum batch quality possible. According to Eirich, the results “were impressive.” The engineers wanted to understand the entire manufacturing process in order to introduce the required improvements. And this involved “looking beyond one’s own backyard” and required some “lateral thinking”. Eirich is unable and unwilling to give precise figures since processes are too complex “and not really calculable as yet.” Concrete data still has to be established as part of the industrial manufacturing process.

The German Engineering Industry Federation (VDMA), of which several member companies are involved in this research, explicitly welcomes the project.



Commenting on this, Timo Feuerbach, VDMA Officer, also responsible for the glass machinery association, said: "This kind of research contributes to further consolidating and expanding the outstanding international position of German glass machinery manufacturers."

#### Asymmetries must be avoided

In addition to proper batch preparation another key task was to post treat the molten glass drops to avoid adverse asymmetries as these have a negative impact on quality. This issue was tackled by *Waltec Maschinenbau GmbH*.

The prerequisite for precise forming here was a homogeneous

temperature situation within the drop, which was the only way to avoid fluctuations in glass wall thickness, which today stand at between 30 and 50 per cent.

The key to the project overall, however, is an aluminium-based lubricant invented by Prof. Hessenkemper. It is applied as a 'wash' to the inside of the moulds into which the molten glass is blown to obtain its final shape. As soon as the glass comes into contact with the lubricant its surface is enhanced. According to Hessenkemper, this stage in the process increases bursting pressure resistance by about 50 per cent and doubles chemical resistance.

#### The aim: a modular system

However, there is still no moulding/forming machine to put the single-stage process into practice. But this "will probably take another five to ten years" admits Kellner adding that the theoretical foundations for the complete process have now been laid. Developing the necessary processes and machinery would require some more time though. In his view, success will be determined by the way these new technologies are introduced onto the market. The aim should be a modular kit with individual modules that can be integrated into existing production

lines without major expense. At present, wall thicknesses of 1.1 millimetres are state-of-the-art, explains Kellner who goes on to say: "Initially, we want to come down to 0.7 to 0.8 millimetres."

The lubricant invented by the professor is now available on the market. It can be used not only for the surface treatment of container glass but – when suitably modified – also for producing flat glass. There is already high demand here, especially from the solar industry.

However, the introduction of the single-stage forming process on an industrial scale promises to provide even greater savings potential than this lubricant. "Overall," says the Professor, "an extra 15 per cent return on investment is certainly possible here." ■



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