Ensuring uniform quality

THE COMPLETE PROCESS OF GLASSMAKING CONSISTS OF DIFFERENT, INTER-LINKED, COMPLEX SUB-PROCESSES WHICH TODAY'S TECHNOLOGY IS STILL ABLE TO OPTIMIZE FURTHER. IMPROVING GLASS QUALITY IS THE AIM OF ENGINEERS AND, EVEN IF ENERGY SAVINGS HAVE BEEN ACHIEVED WITH THE USE OF NEW METHODS, OTHER ECONOMIC FACTORS STILL NEED TO BE CONSIDERED AND IMPROVED. A NEW TYPE OF CHANNEL DESIGN, ELIMINATING DISADVANTAGES SUCH AS POOR EFFICIENCY DERIVING FROM 'CLASSIC' HEATING FROM ABOVE, HAS BEEN DEVELOPED BY GERMANY'S PROGLAS. THIS SAME CHANNEL ALSO CUTS OUT GLASS CONTAMINATION BY DISSOLVING CERAMIC MATERIAL AND VAPOURIZING GLASS COMPONENTS, RESULTING IN GLASS OF GREATER UNIFORMITY AND ENHANCED QUALITY.

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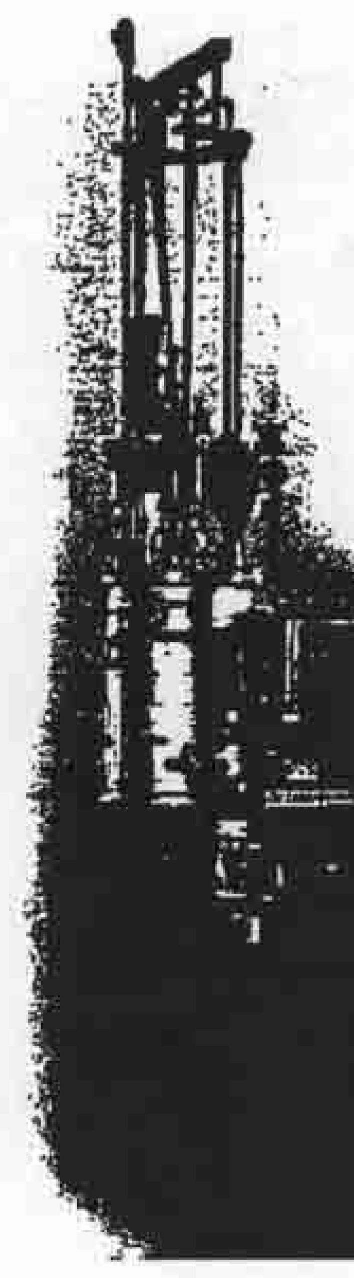


Proglas feeder

In the glassmaking process, engineers' activities continually aim to improve glass quality and the reproducibility of the manufacturing process. Numerous economic factors always need to be considered, and considerable energy savings may now be achieved through the use of new technologies. These savings, in a medium-sized glassworks, can easily exceed a few hundred thousand US dollars.

TRADITIONAL PROBLEMS

The main emphasis in innovations at the hot-end regards controlling the trough and optimising the feeder and presses. The connection between furnace and feeder - the feeder channel - has hitherto been the weakest link in the process chain.

Channels are necessary in order to transport liquid glass from the melting trough to the feeder. These

channels have always been made according to one basic design: U-shaped grooves, whose geometrical form has never been altered. Differences in design have only really been seen in heating. The classic arrangement consists of a type of arched vault over the glass, which is heated with gas burners. Heat transfer results from infrared radiation which is introduced into the glass via the arched vault. An electrically heated variant is mainly used for higher quality glass. It also consists of a U-shaped groove which, however, is covered with a plate. The glass level is adjusted so that the channel is completely full and no hollow spaces can develop between the surface of the glass and the cover plate. Heating takes place by means of electrodes, which are pushed through the groove refractory into the glass, enabling temperature to be controlled electronically.

Until now glass manufacturers have had to accept serious disadvantages with both variants. The 'classic' heating from above gives poor efficiency, which is made worse by the heat losses on the underside of the channel. With this type of channel design, a great deal of money is wasted in the few metres going from the furnace to the feeder. A further weakness of this arrangement is the one-sided heating of the glass. This leads to uneven heat distribution from top to bottom and from the outside to the centre. The variable temperature profile inside the channel leads to non-uniform molten glass flow. The main current develops in the centre of the channel thus causing the glass to flow faster. In the outer area, however, there are slower currents which cannot be controlled.

The molten glass that eventually leaves the channel has therefore had a variable dwell time in the channel, depending on its position in the cross section of the current. This means variable temperatures and, thus, differing viscosity. This non-homogeneity can be seen in the finished glass, with a large number of rejects. Temperature control is a 'hit and miss' affair because glass currents of varying temperature and viscosity intermingle again and again. If, for example, the tonnage is changed, different flow relationships are generated which lead to the elimination of devitrifications and the mixing in of glass close to the refractory. These 'foreign substances' generally show considerable enrichment by aluminium and zirconia and thus lead to glass faults. The electrically heated version of the U-shaped channel improves some of these disadvantages. This channel, however, has a negative effect on the energy balance of the glassworks, as its water-cooled electrodes produce high heat losses.

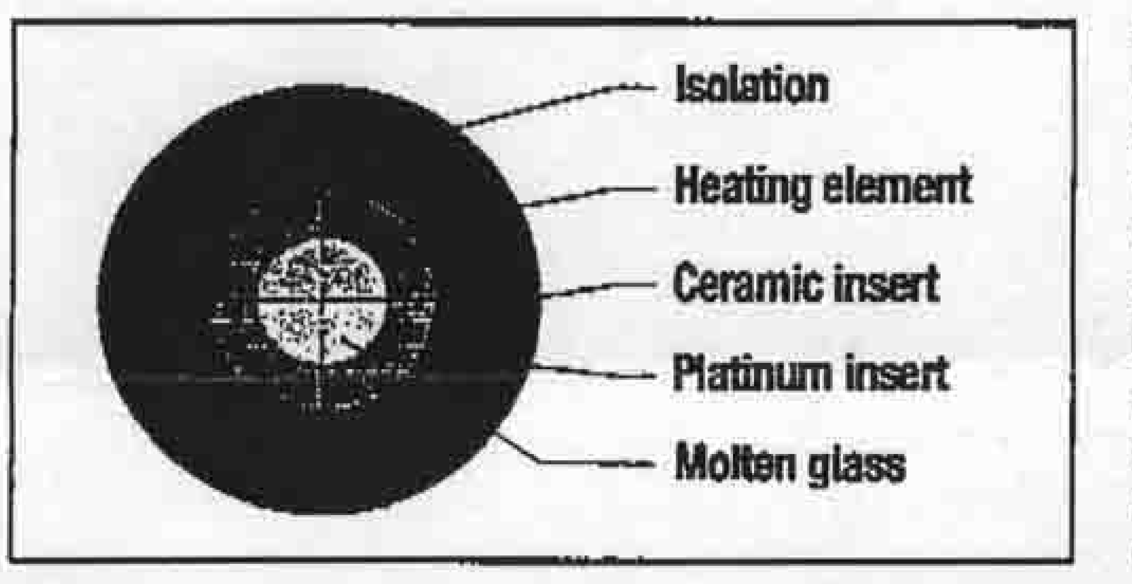
SEEKING THE SOLUTION

German Proglas Engineering, GmbH, based in Forst, has, for many years, worked on the optimization of the manufacturing process for high-quality glass. After successfully introducing new types of technology for feeders and presses, Proglas engineers, in cooperation with *EGLASS Platinum Technology* (EPT), have now applied themselves to the long overdue improvement of feeder channels. The result is an amazingly simple channel design with an outstanding series of advantages.

The channel comprises a closed ceramic pipe in modular form, consisting of lengths of 0.5 metres and 1.0 metres that can be joined together in any combination as required. Various cross-sections with inside diameter from 100 to 200 millimetres are available according to the volume of glass to be transported. The special feature of the pipe is the heating, which consists of ring-shaped heating elements on the outside of the refractory tube, made from platinum alloy cemented into the refractory, and directly heated by being used as a resistor. The channel is very simple to assemble and the modular construction means that only a few spare parts have to be kept in store. The ring-shaped heating elements are embedded in highly insulating ceramic fibre blocks, which behave as active insulation. The heat passes into the molten mass without detours, and losses to the surroundings are minimal. The melt is blasted by heat from all sides. Due to the heating of the platinum, which acts directly on the glass flowing through the pipe, temperature control is highly precise and reacts very quickly.

The result is a very even temperature distribution in the pipe with mi-nimal heat gradients from outside to inside and from top to bottom.

Uniform temperature distribution due to ring-shaped heating is the main reason why there is an equally even flow profile in the pipe cross-section. In contrast to conventional gutters, no parts of



Cross-section of Proglas feeder channel

the glass have differing dwell times in the channel. Contamination of the glass due to dissolving ceramic material does not occur in the new channel, nor is there any vaporization of glass components (vapourization leads to sublimates and, upon falling back into the glass, gives rise to contamination with small stones). The result is that glass of greater homogeneity leaves the channel. These are optimal preconditions for the ensuing processes, which pay off in significantly enhanced and uniformly high quality.

Flexible design features

The new channel design is suitable for all types of glass, including borosilicate glasses with a processing temperature of over 1,400°C, which can be safely transported in the pipe.

The innovation is suitable both for new structures and for retrofitting in existing plants. Due to its modular construction, installation times are extremely short. The constructive connection of platinum - with inherent advantages such as electrical conductivity, hard-wearing, neutrality vis-à-vis glass and the use of high-strength ceramic material - means that durability can be expected to be very long. The glass quality produced is exemplary and, in view of energy savings, the new feeder channel is also an economic alternative to conventional gutters.

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