It was shown during operation of the furnace that the flames emerge from the port drums without touching the lining. However, the inadequate height of the drum (370 mm, for example at the Urshel'sk Glass Plant) caused intense heating of the arches as a result of radiation from the flame.

An increase in the height of the port drums makes it necessary to raise the main crown of the furnace but this is irrational from the heat-engineering point of view and is sometimes not possible. In this case, supporting arches were designed for the main crown over the port drums and these make it possible to bring the main crown close to the surface of the tank and at the same time increase the height of the drums.

The studies on the model and the operational test of the furnace showed that when the fuel is supplied from the back end of the burners it is necessary to maintain the following relationships between the designed dimensions: The distance from edge of burner nozzle to outlet of port drum should not exceed 1.5 m; the height of the port drum should be not less than 500 mm; and the width must be 15-30% greater than the distance between the edge of the nozzle to the outlet section of the drum.

The best results were achieved by widening the drums and having the drum lining at a slope. The slight reduction in the air velocity at the outlet of the drums did not have any significant effect on the characteristics of the flame since the fuel jets with the fuel supplied from the rear have a significant effect on the organization of the shape of the flame.

HIGH-ALUMINA REFRACTORIES FOR THE FEEDERS OF GLASS-MOLDING MACHINES

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The refractories of the gob-feeders of glass-molding machines (sections of the chutes, covering tiles, and other details) are subject to both the action of the glass and to significant temperature changes but are also subject to wear by the constant erosion by the stream of moving glass. Therefore, the following specifications are set for the refractory materials of the feeders: a high glass resistance; uniform corrosion; easy dissolution of the reaction products in the glass; resistance to sudden temperature drops; and sufficient mechanical strength to ensure reliable working during the whole furnace campaign. High-alumina ceramic of a mullite and sillimanite composition meets these requirements to a significant extent.

In Soviet plants the refractory details of the feeders are manufactured from masses with a low Al₂O₃ concentration (35-37%) using a plastic molding method and this does not produce high-quality material of good resistance during use.

In foreign enterprises, high-alumina masses based on natural (most frequently, Indian) sillimanite and synthetic mullite are extensively used in the manufacture of the feeder refractories. The American and West German firms, Cawoods Refractories, Morgan Refractories, and Didier-Werke A. G., which specialize in the supply of refractories for feeders, use masses based on mullite and sillimanite. The Italian firm, Olivotto, uses a refractory containing 55-60% Al₂O₃ for the feeder lining. The principal mineral phase of this refractory is sillimanite.

The x-ray phase analysis of the refractories made by the French firm Seva shows mullite, sillimanite, and α-tridymite. The refractories for feeders produced in Switzerland contain 55-68% Al₂O₃ and the predominant phase is mullite plus a small amount of corundum. As a result of the higher concentration of Al₂O₃ in their compositions, the high degree of nullification of the crotch, and the good glass resistance, such refractories have a useful working life of 3-3.5 yr.

The Gusev Branch of the State Scientific-Research Institute of Glass (GFGIS) has developed the technology of producing refractories for feeders which includes a high alumina concentration (≥ 65% Al₂O₃) and the use of two methods of molding: air ramming (Fig. 1) for details of a simple shape and large-crystal casting of cold-hardening masses for articles of a complicated shape (Fig. 2).
Chamotte made by the Lisichansk Glass Plant was used as the high-alumina filler. This chamotte has the following compositions (mass concentration of oxides, %): SiO₂, 23.3-24.0; Al₂O₃, 71.6-72.3; Fe₂O₃, 0.4-0.8; TiO₂, 0.7-0.8; MgO, 1.0-1.2; CaO, 1.2-1.3; and K₂O + Na₂O, 0.6-0.7.

According to the X-ray phase analysis the deviation of the stoichiometry from that of pure mullite is expressed in the phase composition of the chamotte in the form of the large amount of corundum which, in our view, indicates the incompleteness of the mullitization during sintering. Clearly, this is associated with the low temperature at which the high-alumina material is sintered at this plant (1460°C).

Clay from the Veselov deposits was used as the plasticizer. Veselov clay has the following chemical composition (mass concentration, %): SiO₂, 50.3-50.8; Al₂O₃, 36.4-36.7; Fe₂O₃, 0.7-0.8; CaO, 0.3-0.4; MgO, 0.2-0.3; Na₂O, 0.5-0.6; K₂O, 1.4-1.5; loss on ignition, 9.0-9.5.

In order to improve the molding properties and to increase the strength of the raw product, a moisturizer was used either in the form of an aqueous solution of sulfite alcohol distillery waste, density 1170-1200 kg/m³, or in the form of a clay slip (equal amounts by mass). Using this method of moisturizing, it is possible to obtain the best mixing and the most uniform distribution of the binder in the mixture.

The masses thus obtained were used to make refractory feeder components of a comparatively simple shape in specially designed molds using the air-ramming method. Some difficulties appeared in the ramming of the two-gob feeder bowl but after introducing some design changes to the details of the mold fastening (Fig. 3) it was possible to produce articles of good quality. The unfinished product was dried out to a residual moisture content of 1.5% and the mechanical strength under compression was as high as 5 MPa in this case. The articles were fired in a small gas furnace. The maximum firing temperature was varied from 1350-1420°C and the dwell period from 3 to 18 h.

The articles obtained had the following properties: apparent porosity, 19.1%; density 1460 kg/m³; additional shrinkage on heating to 1350°C, 0.5%; refractoriness, 1770°C; mechanical strength under compression, 70 MPa; temperature of beginning of deformation under a load of 0.2 MPa, 1610°C; and thermal shock resistance, 10 heat changes (850°C, water).