A HIGH SPECIFIC PRODUCTIVITY TANK FURNACE

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The development of a new furnace design and the successful introduction into the production line of this high-productivity furnace were the decisive factors in the technical reequipment of the flat-glass production assembly at the Saratov Technical Glass Plant. This made it possible to install glass-melting equipment of greater capacity on the existing production area while still retaining the main layout of the 30-m-wide furnace building; rationalize the production facilities; and carry out any reconstruction work with the minimum financial expenditure and in a very short time.

The existing furnace had a productivity of 220 ton/day and its length was 70 m. The glass-melting assembly which replaces it has a total length of 45 m (Figs. 1 and 2) and a rated productivity of 360 ton/day.

The planning of the furnace was based on the practical experience of the new, large-scale, glass-melting equipment at the Saratov Technical Glass Plant [1], and on the results of research and scientific developments made by the State Scientific-Research Institute of Glass (GIS), the All-Union Scientific-Research Institute of Technical and Structural Glass (VNII Tekhstroisteklo), the Institute of Gas of the Academy of Sciences of the Ukrainian SSR (IG, AN UkrSSR), and other organizations.

In the development of the high-productivity furnace, particular attention was paid to providing the conditions necessary for intensifying both the capacity of the assembly and of the glass homogenization and conditioning processes.

Fig. 1. Cross section and plan of the tank furnace.
The melting end of the furnace was fueled by six pairs of high-heat-capacity ports which give a high flame coverage of the surface of the molten glass. Like the No. 1 (after the 1977 reconstruction) and the No. 2 equipment now in existence at the plant, it is planned that the ports will have a low-level supply of natural gas plus compressed air through the port units with a v-shaped arrangement of the fuel jets [2]. The average unit heat load on the area of the port drums is (for fuel) 6.2 MW/m² [5.35 Gcal/(h·m²)].

In order to increase the furnace productivity and improve the quality of the glass, it is planned to have supplementary electric heating of the glass. This will be done by the installation of bottom molybdenum electrodes in the region of the hot spot and also in the doghouse region. The total power of this electric heating will be 2100 kW.

One of the latest and very significant improvements used in a tank furnace for intensifying the glass-melting and controlling the position of the edges of the batch zone is the bubbling of the molten glass in the region of the first pair of ports. The compressed air for the bubbling process is supplied through eight nozzles mounted on the bottom of the furnace.

The design of the doghouse, which has two rotary chargers, was developed after taking into account several technical specifications which include the following:

Conditions must be right for the movement of the batch along the central section of the tank;
the distance between the end wall of the flame space and the rotary charger must be increased to improve the operational conditions of the latter;
the surface of the batch must be heated through and melted before it reaches the zone in which the flow of fuel combustion products begins to operate since this decreases the removal of the batch;
it must be possible to carry out visual and television observations on the melting zone from the end wall.

To provide these conditions, a doghouse 6.1 m wide and 3 m long was planned. The roof of the doghouse consisted of two overhanging dinas arches with small angles of rise. The length of the open-surface region was 1.4 m.

The main element in the design of this furnace was the fining and homogenizing region. In designing this region, a heat regime was planned for the end of the fueled part because of the high degree of coverage of the surface by batch and foam and because the boundaries of these zones were close to the last pair of ports. Taking this into account, a rather longer unfueled zone (5.8 m) for the high-temperature homogenization of the glass was planned.

The intensification of the cooling process was a decisive factor in designing the small-scale furnace installation. In calculating and laying out the cooling zone, we took into consideration the higher degree of coverage of the surface with the batch and foam, the temperature potential of the working current of glass, the need significantly to limit the working cycle, and the heat exchange between the melting and cooling ends of the furnace.