A NEW MIXTURE FOR BATCH PREPARATION

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One of the reserves for increasing the output of glass furnaces is the use of batches of constant chemical composition and high homogeneity in melts for the glass. For glass tank furnaces of large capacity this is possible by the all-round automation of technical processes in the batching departments, ensuring high chemical homogeneity in the batches, as a result of the operation of mixers in an automatic cycle with weighing lines.

The system of automatic control of the processes involved in preparing the batches must be highly reliable. The automated lines, in addition to ensuring a high accuracy of operation of the weighing lines, continuously control the nature of the technical process. The delivery of prepared batch to the glass tank furnace requires the use of resources excluding compacting and segregation. Constant technical control of the raw materials is one of the main factors in preparing a high-quality batch on automatic lines.

At the Borsk glass factory a batch is prepared using modernized S-951 mixers with a planetary drive rotating the mixing units (Fig. 1). In contrast to other designs, the basis of these mixers is the blending of the mixtures, in the annular space of the bowl, by the rotary motion of sweeping and mixing blades with simultaneous independent rotation of the blades with respect to the internal surface of the annular pan. The exclusion of central sections in the mixer from the blending volume eliminates the dead zone in which the batch is blended less rapidly than in layers distant from the center. This is a shortcoming of plate mixers of the VA-71 and Eirich types. The batch is located with an open segmental valve in the base of the pan.

The main drive provides for the rotation of crosspieces on which are mounted two pairs of mixers, two cleaning blades on the surface of the pan, and a comb blade close to the internal pan, rigidly secured on the console of a crosspiece arranged perpendicular to the crosspiece of the mixers.

The drive rests on the fixed support plate of the pan base protected by a cylindrical internal nozzle made from sheet metal. The crosspiece rotates about the vertical axis at a rate of 20 rpm. The main drive of the mixer is planetary with a transmission ratio $i = 73.4$. The permitted axial load on the reducer shaft is 2400 kg. The mixers are rotated through an independent planetary gear drive for each pair which is placed inside the frame of the crosspiece and is reliably sealed. The oil tanks of the main drive and the drive for the mixers ensure reliable and long-term operation of the devices. The drive is designed to operate without repairs for 20,000 h.

The axes of the mixers are arranged eccentrically with respect to the axis of the blenders. One pair is fitted close to the surface of the frame of the pan; the second is displaced to the center. This ensures that the area of the mixer is completely covered by the mixing blades, and results in the creation, within all sections of the annular container of the pan, of an active blending zone for the particles. The rotary directions on the crosspiece and the mixers coincide.

The rate of rotation of each pair of blades varies: 52.3 and 68 rpm. This yields a continuous change in the acceleration of the material particles which has a positive effect on the rate of blending. Multistaged location of the mixing blades on the shafts of the mixers ensures intensive blending in the vertical direction. Depending on the angle of approach of the blades to the vertical layer of batch in the volume of the mixers, it is possible to raise the blades, creating a wavelike motion for the entire batch volume with simultaneous blending of the particles of the horizontal layers.

During rotation of the mixers the material is raised and lowered, forming under these conditions a comb of wavelike motion in the batch, the height of which, with the correct angle of installation of the blades, should not be less than 100-120 mm.
The subcomb-blade placed close to the surface of the internal nozzle, rotating simultaneously with the crosspiece, constantly feeds new portions of material under the mixer. The cleaning blade moving over the internal surface of the pans, mixes all the particles and cleans the surface of the mixer to remove batch.

The batch is moistened in the mixer. The water at a pressure of 2 kg/cm², entering the mixer, is sprayed onto the mixture with a special nozzle. Considering that the degree of hydration of hygroscopic materials such as soda, sulfate depends on the concentration of moisture in the batch and its temperature, preheated water (70-80°C) is used for moistening. The batch temperature in this case is 35-40°C, which ensures uniform moistening without the formation of hydrates and free water in the batch.

With a moisture content of 4%, 2 tons of batch consumes about 90 liters of water. The prescribed quantity of water fed into the system is maintained constant by means of the functional control block, which ensures the prescribed working time for the 2K6 pump and the MPM and EPK-1/4 auxiliary mechanisms. The moistening time is 45-47 sec. The entire mix is moistened simultaneously after 25-30 sec following the commencement of mixer loading. The factory operates eight S-951 mixers.

All the mixers are modernized in order to increase the volume of a single loading. The height of the mixer pan has been doubled, and the mixers have been elongated; in addition we have fitted blades on them for blending the mix with a moisture content of 4-5%.

The modernized mixers can be used for preparing batches of from 1000 to 2500 kg. The blending time of the batch in the mixer with a weight of 2000 and 2500 kg is approximately the same. The rating of the electric motor is much less than in the mixers of other types of the same capacity. For mixers with a useful capacity of 1-1.2, 1.5, 2.0, and 2.5 tons the rating is, respectively, 22, 30, and 35 kW. The pan and frame of the mixer can be sealed. Owing to the large dimensions of the inspection traps the mixing tools are accessible for cleaning. The covers of the inspection traps have electric blocking which cuts out the electric motors on the drive during opening of the traps in the cleansing and inspection periods.

The mixers operate in an automatic cycle. Two mixers are installed on a single gravimetric line sequentially, but the line can operate alone. The time for preparing two tons of batch in the automatic cycle on the gravimetric line with two mixers is 3.5 min, the time with one 6.5 min. In this case the quality of the batch is excellent.

The optimum blending time for the batch components was established by the radioactive indicator method; simultaneously we carried out chemical analysis of local samples for each component. The samples were taken from one scale with a blending interval of 30 sec.

From the results of radiometric determinations and statistical processing of the results we found the dispersion of each group of samples taken after 1.5-4 min, from which it was established that the maximum blending time corresponds to the minimal discrepancy in the analysis deviations, and that in the