OAO Uralmashzavod, which is well known as a developer, manufacturer, and supplier of sintering equipment, also offers a full range of services associated with the construction and reconstruction of sinter-production systems, including the development of manufacturing and control systems and servicing.

In 2007, OAO Uralmashzavod constructed a sintering shop for Aksunsk ferroalloy plant, which is a branch of AO TNK Kazkhrom. Technological specifications were developed for the project as a whole, as well as technical specifications for the automatic control system. The basic equipment was manufactured and supplied.

In this shop, high-quality manganese and chromium sinter corresponding to the requirements of ferroalloy production (in terms of ease of reduction, strength, content of fines, etc.) may be produced from unconditioned ore siftings and dust from ferroalloy furnaces. The projected capacity of the shop is 80000 t/yr manganese sinter and 270000 t/yr chromium sinter. Such output is made possible by a single sintering machine with a sintering zone (60 m²) and a cooling zone (60 m²).

The presence of a cooling zone in the sintering machine permits a compact design, with simple organization of the equipment. The life of the equipment processing the sinter cake (crushers, screens) is longer than for machines with traditional cooling. By cooling the sinter on the belt of the sinter cars, thermal stabilization is possible, with disintegration of the cake along lines of natural cracking. That increases the product yield, by reducing its content of large pieces and fines. The sinter produced is strong, thanks to complete combustion of the carbon in the solid fuel; is relatively easy to reduce, on account of its large porosity; and has a low content of fines, because recharging of the hot sinter is eliminated.

The sintering machine is equipped with an up-to-date ignition furnace, with free positioning of the burners. The furnace can operate on the basis of gas from ferroalloy production or diesel fuel. The free panels of the furnace permit the installation of solid-fuel burners. Automatic control and monitoring of the ignition is provided. In the furnace lining, lightweight aluminosilicium components are employed, with significant reduction in metal content of the structure.

The preparation of the dust from ferroalloy production is as follows. The dust from the intake silos is supplied, with water, to a high-power mixer with a frequency-controlled drive (productivity 10 t/h), where it undergoes mixing, wetting, and microgranulation (Fig. 1). The batch is mixed in a chamber containing two shafts with blades turning in opposite directions. The inclination of the blades may be varied over the length of the shafts, to adjust the motion of the mate-

**Fig. 1. Screw mixer.**
to remove dust buildup from the blades, special blades are provided in the upper part of the mixer, over the whole length of both shafts.

On account of the high sintering temperatures (up to 1240°C for manganese sinter and 1440°C for chromium sinter), the grating includes a protective layer (base). The base fraction (8–15 mm) is separated by means of a double screen (Fig. 2), with 15-mm holes in the upper screen and 8-mm holes in the lower screen. In addition, screening permits separation of the +15 mm fraction (the final sinter) and the 0–8 mm fraction (returned to the batch). Single-stage screening significantly simplifies the shop configuration and the maintenance of the discharge and sorting systems. The use of a two-mass screen reduces the dynamic loads on the supporting structure by a factor of 5–7 in comparison with single-mass screens.

Another adaptation to the high sintering temperatures is the use of heat-resistant sintering cars, whose frame is made of 20XM1 steel.

The usual sintering-machine configuration with sinter cooling on a belt involves purification of the exhaust gases from the sintering zone in an electrofilter and purification of air from the cooling zone in cyclones. However, in the production of manganese and chromium sinter, dust is formed. According to official Kazakh standards, it is of risk classes I and II. Therefore, two-step gas and air purification is employed; the second stage employs bag filters with thermostable filter material (Fig. 3). To reduce the environmental impact, the exhaust gases from sintering are recirculated, by means of exhaust fan F2. The gases are delivered to the hood of the sintering zone, with corresponding reduction in solid-fuel consumption in sintering by 2.0–2.5%; the temperature in the combustion zone rises, and the gas emissions to the atmosphere are reduced by 25–30%.

The sintering shop is able to produce two types of sinter in a single machine, by switching periodically from one raw material to another. The switching frequency depends on the needs of ferroalloy production. The shop provides a single shared system for the intake, dosing, mixing, pelletization, charging, and sintering of the batch and the cooling and sorting of the sinter. To reduce the switchover time, the losses of metal, and the proportion of unconditioned sinter, the system includes separate bunkers for the batch, the recycled sinter, and the base component used in the production of manganese and chromium sinter, as well as separate silos for the dust from ferrochromium and ferromanganese production.

Operational protocols for the switchover period have been formulated. Before switching from one product to another—say, from manganese to chromium sinter—the intake bunkers in the shop are completely emptied of manganese material, while ferromanganese dust is removed from the silos. The mixer, pelletizer, and bunker of the sintering machine are completely emptied of manganese material. The channels supplying recycled sinter and the base component, as well as the discharge channels and bunkers for the sinter produced, are completely emptied of manganese material. As the intake bunkers are emptied, chromium material is introduced, while dust is pumped into the silos for ferrochrome production. After these operations, the dosing of chromium batch components begins, including recycled sinter and base component stored in previous periods. Correspondingly, the recycled sinter and base component for use...