An analysis of the results of measurements of the noise level in the blast-furnace and steel-melting departments of many iron and steel plants has shown that in the blast-furnace departments the most intense sources of noise are the snort valves, the screens, and the hot-blast stoves, and for electric melting furnaces and open-hearths they are blowers and the circulating-pump equipment. There is also a high level of noise when steam escapes from the waste-heat boiler.

To a significant degree the noise level from steel-melting furnaces depends upon their capacity and operating sequence. For example, in the operation of a 180-ton electric furnace the noise level is an average of 8 dB higher than in the operation of a 5-ton furnace. The loudest noise is at the start of melting.

The distribution of noise levels over the area of the shop is characterized by noise charts (Figs. 1 and 2). They are schematic plans on which solid lines are used to show equal noise levels in decibels with conditional division into classes with a range of 5 dB. Let us consider methods of reducing the noise level and protection from it during operation of the equipment.

The air-discharge valve. Discharge of compressed air into the atmosphere through the air-discharge valve (snort valve) occurs with a large excess pressure and is accompanied by intense noise. Existing methods of reducing the noise (the use of a type M 101-21 silencer or exhausting of the air into the chimney stack) did not provide reduction of it to the standard. In the working area of the gas fitter at a distance of 4 m from the valve the noise level (in the frequency range of 63-8000 Hz) exceeds the allowable by 5-19 dB. For effective reduction of the noise the installation of a silencer (Fig. 3) on the valve is recommended. It consists of a perforated steel tube 1 with a covered outlet and an outer steel cylinder 2 lined with sound-absorbing material 3. The tube is perforated with holes 20-mm in diameter (perforation coefficient 18%), which additionally reduces the noise by 6-8 dB.

In this case normal sound-absorbing materials are unsuitable because of the high rates of air flow and the presence of moisture. Therefore steel wool was used as a sound-absorbing material. This consisted of a 60-mm layer of matted 0.1-mm-diameter steel wire pressed to a density of 500-700 kg/m³. The sound-absorbing lining is held by a lattice of 3-mm diameter steel wire and is fastened to the silencer with steel plates. In the normal range of frequencies the coefficient of sound absorption of the lining is an average of 0.8.

With a silencer diameter of 1.5 m and length of 2 m, such a lining provides the required reduction in the noise level at frequencies above 500 Hz. Taking into consideration the additional reduction in noise at low frequencies with the use of perforations, the silencer reduces the noise level in the working area of the gas fitters to a level acceptable to standards. The installation of the silencer made practically no reduction in the capacity of the air-discharge valve.

Screens. The main reason for the occurrence of noise in the operation of a screen at low and medium frequencies is vibration of the side walls of the box and of the spouts caused by the centrifugal forces occurring during rotation of the off-balance, by the impact character of the interaction of the vibrator bearing-assembly parts, and by the impact of lumps of the material being sorted.
Fig. 1, Noise chart for a blast-furnace department: 1) blast furnace; 2) hot-blast stoves; 3) hot-metal cars; 4) slag cars; 5) coke screen.

Fig. 2. Noise chart for an electric-furnace melting shop: 1) 100-ton furnace; 2) control panel; 3) molds; 4) pouring crane.

It is possible to decrease the noise level by changing the operating parameters of the screen. For example, with halving of the rate of rotation of the vibrator off-balances the noise level will decrease an average of 10 dB. Halving the amplitude of oscillation of the box decreases the noise level by 3-4 dB.

Also effective is adjustment of the elastic connection between the casing of the vibrator and the frame of the screen. For example, with installation of shock absorbers of 20-mm-thick technical sheet rubber between the vibrator bearing-assemblies and the walls of the box the noise level from the screen decreases an average of 9 dB.

In screening comparatively cold materials (t < 100°C) it is desirable to use rubber screens or to rubber face them with 4-5-mm-thick wear-resistant rubber. Reduction in the noise from the spouts is obtained by facing their external surfaces with wear-resistant rubber or by placing a packing 15-mm thick of soft rubber between the walls of the spouts and the interchangeable lined plates. Production tests of the effectiveness of reducing the noise from shakers were made in the ore-beneficiation plants of Krivoi Rog Ore Basin.