CONSTRUCTION OF SINGLE-CHANNEL PORTS ON THE 90-TON OPEN-HEARTH FURNACE

L. N. Muromskii and P. I. Tikhonov

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In November 1960, the 90-ton open-hearth furnace, which operates on fuel oil, was modernized. Before modernization (Fig. 1) the burner bulkheads (the brickwork between the vertical channels) and the roof of the slag pockets on which the brick work of the ports rested had the shortest life on the furnace. Therefore the ports were made as single-channel with breastwalls extending to the roofs of the slag pockets (Fig. 2). The main roof of the furnace was made of 380-mm burnt magnesite-chromite brick with 460-mm ribs.

The breastwalls of the vertical channels are constructed from 460-mm burnt magnesite-chromite brick suspended by the usual method by means of plates and pins. Suspension is done in every third brick. Since the breastwalls concave into the furnace, the holes for the pins are drilled in the thin end of the brick. The 2920-mm radius of curvature is taken as minimum for MKhS-13 wedge brick. The plates are fastened by means of 6-mm diameter hooks to the arched beams resting on the furnace body.

The sidewalls of the vertical channels are made straight, resting on the Dinas rings in the roofs of the slag pockets. At the level of the working platform, relieving beams were placed in the brickwork of the vertical channels in place of the usual "baskets."

The slag pocket roofs, with the exception of the Dinas rings, and the roof between the slag pockets and regenerator (fantail flue) were made as thrust suspension roofs of 380-mm magnesite-chromite brick. The vertical channels have a section equal to 4.3 m², which is somewhat less than the total section of the two channels (4.8 m²) of the two-channel ports. Type UPI-K burners with a 24/28-mm nozzle were installed in the movable water-cooled tuyeres, which are inserted into the furnace through short port holes.

Fig. 1. 90-ton open-hearth furnace before modernization.
Fig. 2. Modernized 90-ton open-hearth furnace with single-channel ports.

To cool the tuyeres, which are inserted without a protective insulation into the working space for a distance of 1750 mm, special pumps (working and reversing) were installed which increased the water pressure from 1.5 to 3.0 atm gage. To protect the tuyeres from burning in case the supply of water is cut off, automatic devices were installed which switch on the electric drives for withdrawing the tuyeres. The tuyeres were never once overheated during three campaigns.

The remaining parts of the furnace remained unchanged during the modernization. In particular, the straight main roof of the furnace and its height above the sills of the charging ports were left intact. The hearth dimensions were also left virtually unchanged.

After reconstruction, the furnace operated about two years. In the table are given the average operational data on the work of the furnace during three campaigns before modernization and during three campaigns afterwards. The table was compiled so that major repairs with considerable expenditures of refractories and time do not enter into a single one of the examined campaigns, which enables us to compare the operational indexes during the various working periods. In the campaigns before modernization of the furnace, the main roof was constructed of 380-mm BMKhS brick, and after modernization, from 380-mm MKhS brick with 460-mm ribs.

Before modernization, when making intermediate repairs, which was usually done at the 250-280th heat, it was necessary to perform major work on the burner bulkheads and vertical channels, and sometimes to replace completely the ports up to the roof of the slag pockets. After modernization only the sidewall of the vertical channels above the level of the working platform is replaced during intermediate repairs in the ports.

The suspension construction showed a high durability during the three campaigns. For security the breastwalls were completely replaced after 550 heats during the first repairs. In the next repair after a campaign of 615 heats, a part of the breastwalls was left for the next campaign.

The condition of the furnace when it was shut down for repairs after modernization showed that with the usual construction of the ports and brickwork of the main roof of 380-mm burnt magnesite-chromite bricks with 460-mm ribs, the duration of the furnace campaign can be increased still further.

It is necessary to point out also the high durability of the thrust magnesite-chromite roof of the slag pocket and regenerator. After three campaigns, these roofs on both sides of the furnace did not have a noticeable wear, whereas the Dinas roofs of the regenerator adjacent to the suspension magnesite-chromite brickwork were partially replaced during the second and third repairs. Experience shows the advantage of continuing the magnesite-chromite roof at least to the middle of the regenerator.

The property of single-channel ports to increase the specific consumption of fuel was noted in this case.