This method makes it possible to produce active slags and hence to speed up the operation. The thermal capacity of the furnace has now been increased and basic roofs have been installed; the time for finishing has therefore been reduced still further. The time for finishing in heats with a 120-125 t yield of useful metal is 1 hr 10 min, maximum 2 hr 20 min. This method has also been used for the firing of furnaces by high-sulfur fuel oil at the Verkhne-Ufaleisk Metallurgical Plant. Good results have been obtained.

The use of limestone instead of lime in heats with a sulfur content of less than 0.070% on fusion gave hardly any reduction in the finishing time. This method is best used when smelting steel with a sulfur content up to 0.020% and a high content of sulfur on fusion. This will help to improve steel production for the Seven Year Plan and considerably reduce the cost of the metal.

REDUCING METAL LOSSES DURING THE POURING OF STEEL

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Translated from Metallurg, No. 10, pp. 29-31, October, 1962

All the steel smelted at the Chelyabinsk Metallurgical Plant is bottom poured. The mold trains are assembled in the department for mold train preparation.

It is a well-known fact that in bottom pouring the metal losses are much higher than in top pouring.

<table>
<thead>
<tr>
<th>Metal losses</th>
<th>Years</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Into runner guide</td>
<td>0.098</td>
<td>0.038</td>
<td>0.029</td>
<td>0.027</td>
</tr>
<tr>
<td>Into runner pipes</td>
<td>0.024</td>
<td>0.015</td>
<td>0.013</td>
<td>0.008</td>
</tr>
<tr>
<td>Total</td>
<td>0.122</td>
<td>0.053</td>
<td>0.042</td>
<td>0.035</td>
</tr>
</tbody>
</table>

During the filling of molds by the steel the metal sometimes breaks through the runner reservoir. As well as direct metal losses, the expensive interchangeable equipment is put out of action: trays, molds, runners, hot-tops and steel-pouring cars. Much time is expended in rectifying these matters and the rhythmic operation of the pouring bay is interrupted.

The designers and leading workers of our department, together with workers from the Central Plant Laboratory, the refractory department and the inspection department have tried very hard to reduce rejects; as a result of a number of organizational and technical measures the rejects have been reduced from 0.122% in 1958 to 0.035% in 1961.

A large part of the metal was lost in the runner guide (Table 1). During the pouring molten steel exerts a pressure with the same force on all sides of the runner reservoir, and the poorly packed sections cracked and the metal ran out. In contrast to the side walls the metal did not reach the lower part of the runner brick since this wall lay at the bottom of the tray channel, resting on the "bed" of dry earth or sand, sieved through a fine sieve (1-1.5 mm). The area of the joint between the mold and runner was very vulnerable since at this point the runner was left unloaded.

The first portions of hot metal set up a thermal shock, the runner brick, not being packed, split and the molten metal flowed into the cracks.
A mixture of 50% scale and 50% dry sieved earth was used to pack the runner reservoir. Special tools were used to pack this mixture into the gaps between the runners and the wall of the tray groove (Fig. 1).

Packing the gaps with the mixture not only prevents free expansion of the runner reservoir, but when there is a holdup the metal solidifies, being in contact with the scale. In order to ensure reliable packing, special 3-4-diameter bars sharpened at the end are used to check the clearance between the runner and the wall of the tray channel.

In order to prevent metal leaving through the top of the reservoir, we used metal plates measuring 2 x 100 x 450 mm. These plates were applied immediately to the runner brick near the runner and mold, covering the gap. The runner guide was packed from the top through a metal plate by the weight of the mold and runner, and if the metal still ran out, it solidified fairly rapidly on coming into contact with the plate. It was important that the lining of the trays was uniform, without "steps", on one level with the edges of the tray, and the mold was held tightly against the runner.

The metal frequently broke out due to the low temperature of the runner reservoir and the trays; the brick therefore cracked and the steam from the undried refractory paste tore the runner guide. At the refractories store the runner reservoir was therefore heated by steam batteries, and the trays were assembled at temperatures of not less than 120°. To avoid holdups in the mold train preparation, gas pipes were mounted under the assembly platforms, and special square linings of 70 mm² cross-section were laid near the trays; this made it possible to heat the trays if necessary immediately during the preparation of the mold train.

The "doughnuts" which are laid near the molds and runners when they are fitted onto the trays are completely dried when the mold and tray temperatures are 120-140°.

A large amount of metal was also lost through the runners. The previously used design of runner (Fig. 2) had poorly packed runner pipes, since the halves of the runner were joined in the middle of the pipes. Furthermore, the operation of the runner was difficult and dangerous because of the poor method for fastening both halves with coupling rings and wedges. A new design of runner has been used since 1959 (Fig. 3). The new runner is larger (which is much better for packing the runner guide from the top) and ensures much more reliable packing of the runner pipes. The pipes are almost entirely within the runner body and only have covers on the top; the covers are fastened with pins with small wedges and no coupling rings are used at all.

Furthermore, on the suggestion of designer D. F. Sekisov, the assembly of pipes onto templet is performed on a pneumatic bench; this facilitates the work and makes it possible to check the runner pipes for the absence of cracks.

When they are laid in the runner body, the runner pipes assembled on the templet are rotated together with the templet so that the "bed" of refractory paste uniformly fills all the slits without leaving voids. Before being mounted on the tray the runners are carefully dried, the state of drying being tested by checking the gap between the lid and housing with a small metal bar. To improve the drying the runner is covered on the top by an iron lid.