Conventional stoves with a blast temperature of about 1000°C were previously used to heat the blast for the blast furnaces at the metallurgical plant in Koshitse, Slovakia. An increase in the useful volume of these furnaces made it necessary to heat a larger volume of blast and increase its temperature. A new stove with a self-supporting mushroom-shaped dome was built. The stove was provided with a checkerwork made of high-quality refractories and a lining with keyed joints was installed in the combustion chamber. The combustion products from the combustion chamber are discharged in the vertical direction. The lining of the dome is not connected to the outside lining of the stove.

The first pig iron made in Slovakia was produced in the town of Koshitse on three 1719-m³ blast furnaces. The furnaces came on line in 1965, 1967, and 1969, and the blast air was heated in conventional stoves to roughly 1000°C.

As the useful volume of the furnaces increased, it became necessary to heat a larger volume of blast and increase the overall temperature of the latter. New stoves with an external combustion chamber and a heating surface of 100 m²/m³ volume were installed for the second blast furnace, which now has a volume of 2413 m³. The introduction of the new stoves made it possible to increase blast temperature to 1200°C. A new stove with a self-supporting mushroom-shaped dome was designed for furnaces No. 1 (volume 1880 m³) and No. 3 (volume 2150 m³). The reconstruction project also involved the installation of new checkerwork composed of quality refractories. The combustion chamber was lined using keyed joints. The factory also installed a ceramic burner in which the combustion products travel in the vertical direction. The lining of the dome is not connected to the outer lining of the stove. The dome lining, resting on the dome’s supporting ring, was constructed of high-quality refractories. The idea behind the self-supporting lining is the installation of quality refractories on its internal part that compensate for the lining’s expansion and the use of an expanding material for the lining proper. The mushroom shape of the dome makes the shell and the lining more stable.

A traditional blast-furnace stove has a built-in limitation on the maximum temperature of the dome (up to 1250°C) and is also characterized by inadequate heating surface (33435 m³).

The new type of stove makes maximum use of the properties of the refractory material: dome temperature is increased to 1500°C, heating surface is increased to 42122 m², and installation of the stove on the site of the old stove does not require a new foundation or new pipes. The main difference between the traditional and new stoves is the design of the self-supporting dome.

The main parts of the stove are the steel shell with its unions, the checkerwork, and the refractory lining. The specifications of the furnace are shown below:

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total height, mm</td>
<td>44858</td>
</tr>
<tr>
<td>Height of combustion chamber, mm</td>
<td>34283</td>
</tr>
<tr>
<td>Height of checkerwork</td>
<td>37602</td>
</tr>
</tbody>
</table>
Area of heating surface, m$^2$ .......................... 42122

Maximum allowable temperature, °C:
  under the dome  ....................................... 1500
  in the flue gases ...................................... 400

Efficiency, % .......................................... 81.14

Type of burner ........................................... ceramic

Type of checkerwork ................................. parquet

The unions are welded to the steel. The cylindrical lower part – the part where the unions are attached – is reinforced. The lower part also includes a load-bearing ring.

The checkerwork (Fig. 1) consists of posts and gratings that create a space for entry of the cold air and escape of the flue gases. Supports for installation of the heat-storing checkerwork are also provided in the stove.

In terms of its functions, the refractory lining is divided amongst the outer facing, the heat-storing checkerwork, the ceramic burner, and the dome. In terms of height, the lining is divided into zones I, II, III, and IV (Fig. 2).

The outer facing consists of four layers extending over the entire height of the stove. The innermost ring of this facing corresponds to the quality of the materials in the individual zones of the checkerwork. The lining (Fig. 3) of the combustion chamber consists of two layers (over the entire height) that are formed by refractory beams and are connected by dowels.

The heat-storing checkerwork (Fig. 4) is the main part of the refractory lining. The function of the checkerwork is to store the heat of the flue gases and transfer it to the region occupied by cold air. Two types of specially shaped blocks (N105 and N106) are used, with each block having 11 cells (average cell diameter 38 mm). The blocks are laid in parquet fashion, so that the cells are continuous over the entire height of the checkwork.

The ceramic burner (Fig. 5) is located in the lower part of the combustion chamber. The feed of gas and air is along the vertical axis of the chamber. The lining of the burner consists of special blocks connected by dowels. The composition and form of the blocks are such as to allow air to be fed into the upper part of the burner at a 45° angle to the gas flow. This leads to optimum combustion of the gas.

The lining of the dome (Fig. 6) consists of five layers connected to the shell of the self-supporting dome without an intervening gap. The bottom layer rests directly on the supporting ring of the dome. The arrangement of the special lined blocks used for the dome corresponds to the dome's mushroom shape. All of the pipes for this system are provided with special valves and gates. Platforms, catwalks, gangways, and ladders are provided to access the individual components. A crane is used to perform repairs or to replace the reinforcing lining.