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ANALYSIS OF THE TECHNOLOGICAL SCHEME OF FIRE-RESISTANT BRICK PRODUCTION

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Abstract
The article describes the Sito-burat SM-237A machine for sorting raw materials of refractory bricks, which is used in chemical industry, building materials production, and metallurgical industries in our country, and the analysis of the technological scheme of refractory brick production.

Keywords: Sito-burat SM-237A, firebrick, sorting device, granulometric composition, production, raw materials..

Introduction

Refractory bricks are of great importance in the production of chemicals and building materials. They are used for internal lining of devices operating in various aggressive environments and at high temperatures. But today, a certain part of the bricks used for lining is made at the expense of imports, which causes an increase in the price of manufactured products [1-4]. In order to solve these problems, the enterprise specializing in the production of glass products and construction glass has launched the production of refractory bricks based on the localization program. However, the competitiveness of the currently produced products with foreign products of this type is not sufficient. Because one of the main reasons for this is that the granulometric content of the products added to 1 ton of raw materials is not correctly selected [5-11].

To produce high-quality and durable firebrick, it is necessary to consider its granulometric composition, baking temperature and baking time. The baking time and temperature of the refractory brick produced at the enterprise is almost the same as that of this type of product produced abroad. The only difference is that the raw material of 1 ton of fireclay firebrick is not at the required level of granulometric content when it passes through the sorting machine.

Refractory Materials

Refractory materials (materials that can withstand high temperatures) are used in the construction and maintenance of ceramic studio kilns. Fire brick, ceramic fiber and castable refractories are the three forms of refractories used in kilns, but fire brick is the most significant.

A Brick with Many Faces

Fire brick is a generic term that encompasses any brick that can withstand repeated heating and cooling at various temperature ranges. Additionally, fire bricks must be able to withstand different atmospheres, provide various structural or insulating qualities, and due to the difficulty in cutting them, must be available in a variety of shapes to add flexibility to kiln design and construction.

Hard and Soft

There are two types of firebrick: hard brick and soft brick. Hard bricks are very dense and durable and used for their structural qualities. They can be found most often as the main building component of large kilns, chimneys, fireboxes and burner ports - anywhere around direct flame. Soft bricks are lightweight and made from a refractory clay body containing combustible materials. When fired, the materials burn out leaving a sponge like matrix of air pockets, which serve to provide insulating qualities to the brick. Also known as insulating firebricks (IFBs), these bricks absorb about half the energy as hard bricks during a firing. Soft brick ranges from 2000°F to 3300°F and are used as the brick of choice for constructing electric kilns or as insulating liners in reduction kilns [12-19].

Grades Are Important

The main ingredient in fire bricks is fireclay, which contains mostly alumina and silica, elements capable of withstanding high temperatures. Hard bricks are available in several grades, depending on their composition and properties, which determine the most efficient use of them in construction. High alumina compositions start at 50% alumina and increase in alumina content to 98% for the highest purity and most expensive. It's extremely rare that a potter would require an alumina content exceeding 70%.

Low-duty: Typically rated to 1750°F maximum service temperature. Primarily used for fireplace chimneys and contains 24–26% alumina.

Medium duty: Temperature rating to 2700°F maximum service temperature. Uses include backup linings, lower-temperature ceramic kilns and chimneys, and contains 34–38% alumina.

High Duty (first-quality firebrick): Temperature rating to 2850°F maximum in purely heat service. Certain atmospheres can reduce this temperature rating by several hundred degrees and contains 36–40% alumina. Uses include boilers, ceramic kilns, chimneys and back-up linings.

Super Duty: Temperature rating to 2900°F in pure heat service. Certain atmospheres can reduce this temperature rating by several hundred degrees. Same uses as high duty where higher temperatures are involved. Contains 40–44% alumina.

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High-Fired Super Duty: Temperature rating between 3000°F–3150°F. A higher burned version of super duty firebrick designed to lower the porosity, increase physical strength and improve resistance to alkali attack and carbon monoxide disintegration. Contains 40–44% alumina [19-27].

Shapes. Most bricks are pressed or extruded. Common shapes are straights, arches, wedges, keys, rotary kiln blocks (RKBs) and square-edge tiles. Larger pieces are typically produced by air hammering the brick mix into wooden or steel molds sized for the desired shape dimensions. The standard refractory brick size is 9×4½×2½ inches, also known as one brick equivalent (beq). This size is the most common used in pottery kiln construction. However, an equally popular standard size used in industrial furnace construction is the 9×4½×3-inch series. The 3-inch series brick reduces the number of joints in the kiln.

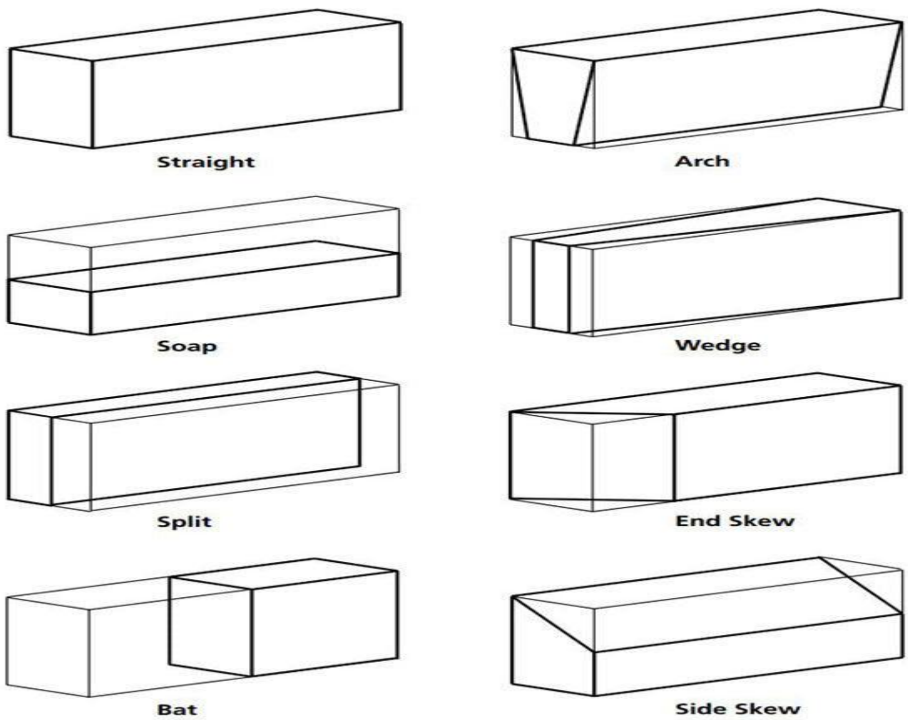

Fig-1. Type of firebricks.

Straights - The standard straight is 9×4½×2½ inches or 9×4½×3 inches and available in larger sizes up to 18 inches long, 9 inches wide, and 4½ inches thick.
Square edge tile - This term refers to "big" straights, which comprise 12×12 inches up to 24×12 inches with thickness ranging from 1½ to 3 inches.
Soaps - A term used to describe a half brick in width such as 9×2¼×2½ inches or 9×2¼×3 inches.
Splits - A term used to describe the thickness of a brick thinner than 2½ inches, i.e., splits come in 1, 1¼, 1½, and 2-inch thicknesses.
Arch - This shape tapers in thickness along the width over its entire length and is used to make sprung or circular barrel arched roofs either 4½ inches or 6 inches in thickness.

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Wedge - This shape tapers in thickness along the entire length of the brick and is used to make sprung or circular barrel arches 9, 12 or 13 inches in thickness.

Skew - A shape having a certain taper on one side or end to enable a sprung arch to be built. Four major types are available in both side and end skews that relate to the rise of the arch [22-31].

Revolving sieves are mainly used in the production of refractory bricks. Sito-Burat SM-237A raw material sorting device is used at the enterprise. Sito-burat for heavy brick:

- from 1 fraction – 30% (300kg),
- from 2 fractions - 23% (230kg),
- from 3 fractions – 10% (100kg)
- secondary kaolin - 26% (260kg),
- SP kaolin AKS – 11% (110kg) and
- humidity - 5÷8%.

Almost all types of refractory bricks are resistant to temperatures above 13500C. The first artificial product of refractory brick consists of aluminosilicate brick obtained on the basis of the SiO2 - Al2O3 system and siliceous brick made on the basis of the SiO2 equilibrium diagram [31-33].

The raw material of refractory bricks passes through several stages before reaching the sorting process, and the quality of the work done in these processes has either a negative or a positive effect on the sorting process. The raw material brought to the warehouse first enters the jaw crusher, and then it is delivered to the begun using a vacuum conveyor. At the next stage, the raw material enters the sorting machine, where it is separated into three different fractions using the Sito-burat SM-237A device.

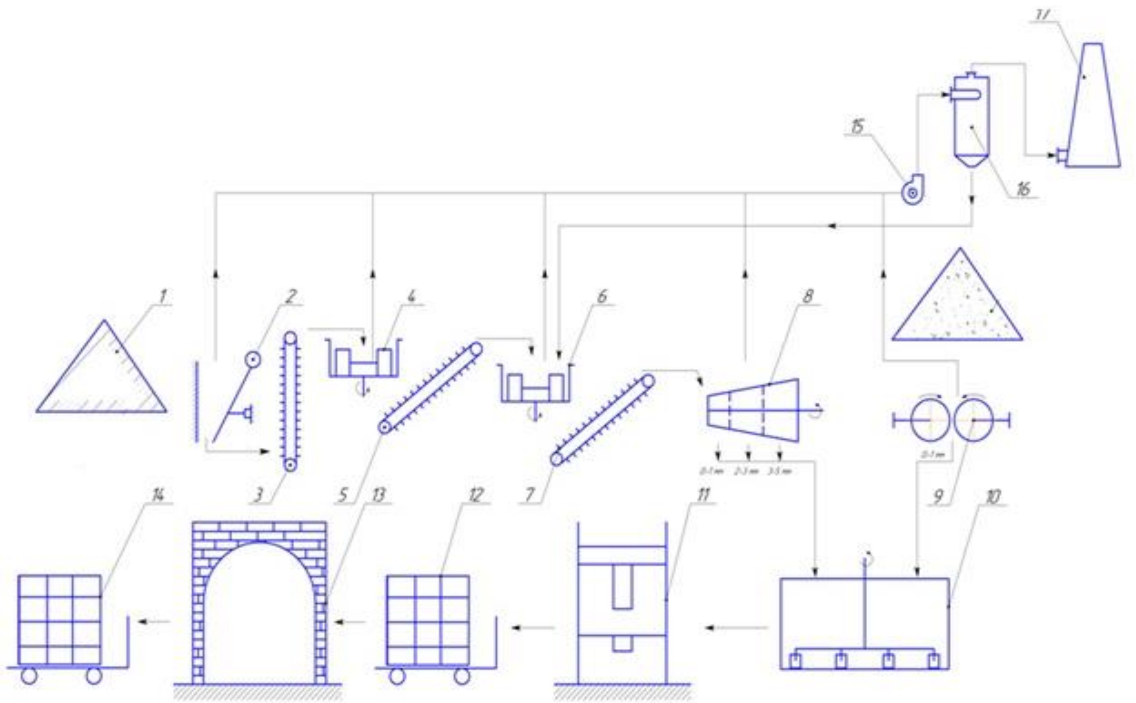

Fig-2. The technological scheme of firebrick production

The technological scheme of firebrick production is given. The raw material of firebrick is brought to the warehouse of the enterprise (1). In this case, ceramic secondary brick, alumina and other components are sent to a jaw crusher (2). The size of the raw material passed through the jaw crusher is in the range of 20-50 mm, and it is delivered to the begun (4) through the elevator (3). The raw material is sent to the begun (6) through the elevator (5). Crushed and crushed raw materials are brought to the sorting machine (8) using an elevator (7). In the sorting machine, raw materials are divided into 3 fractions. The raw materials sorted in the required sizes are poured into special places. Raw materials are mixed in a mixer (10). Kaolin is ground to 1 mm in a roller grinder (9). In the next step, it is pressed through a press (11) to the required size.

Pressed bricks (12) in the finished state are taken to the furnace (13) for baking. Baked brick (14) for the required time is ready for use. The dust produced by the jaw crusher, begun, sorting machine and roller crusher is drawn through the fan (15) and sent to the cyclone (16) for cleaning. Purified gas is discharged through the smoke exhaust chamber (17).

Conclusion

Analyzing the current state and future prospects of refractory brick production, the main operating modes of sieving devices in the process of sorting raw materials were analyzed. The shortcomings of the design of the elash device were studied. Sito-burat SM-237A's design flaw is that the raw materials received by it, which is the main feature of the machine, do not have the same granularity content when dividing the raw materials into fractions. passing, as a result, has a negative impact on the quality of the manufactured products. Because the required amount of fractions is added depending on the brand of fire-resistant brick being produced.

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