NEW TECHNICAL AND TECHNOLOGICAL INNOVATIONS BEING USED IN THE RECONSTRUCTION OF CONTINUOUS SECTION MILLS AND ROD MILLS

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UDC 621.771.25:06.004.68

In order to solve important problems in metallurgical production – improving the accuracy and overall quality of finished rolled products, increasing usable output, automating production operations, conserving energy and material resources, and making the operation of rolling mills more efficient by shortening the time spent on roll-changing, adjustments to the mill, etc. – metallurgical plants are making improvements to both the rolling operation and to the equipment used to execute it.

This article presents a brief overview of the technical and technological innovations being made in the construction and reconstruction of section and rod mills.

The most important problems in obtaining finished rolled products are increasing the productivity of the mills, improving the quality indices of the rolled products, increasing usable output, and making more efficient use of the existing equipment (increasing the value of the coefficient that characterizes the efficiency of the operation of a rolling mill).

Described below are different approaches that have been taken at foreign metallurgical plants and plants within the CIS nations to solve the above problems.

Increasing the productivity of rolling mills. The Italian company Danieli has introduced several measures to increase productivity and improve the technology and equipment used to make wire rod [1]. In accordance with the modifications that have been made to the production process, 8.3-mm-diam. semifinished products obtained in the same line as the modern high-speed rod mill operated by the company are sent through Delta-type (8–10 passes through each block) leader and finishing blocks at a speed of 61.5 m/sec before entering the continuous train. The temperature of the semifinished product is controlled as it moves through these blocks. Thanks to several innovations – especially the newly designed coil stacker – rolling speed on the rod mill has now been increased to 140 m/sec. A decrease in finishing temperature to 750°C is allowing mill operators to control grain size and, thus, also control the quality indices of the wire rod.

The continuous section mill built by the South Korean firm Posco and put into operation more than 20 years ago has been rebuilt in accordance with a design developed by the Kocks company. The modification involved the installation of a four-stand block of three-roll stands in the finishing train in place of stands Nos. 16 and 17 (with use of the stands’ motors for the new block). Each of the rolls in the block is driven by its own shaft through a common reduction gear. A total of
450,000 tons of rolled products was produced in 1998 on the rebuilt mill, which had a capacity of 350,000 tons/yr before reconstruction.

The rebuilding project thus increased the mill’s capacity by 25%. The mill is used to make 5–13-mm-diam. wire rod and 14–42-mm-diam. sections of medium-carbon, corrosion-resistant, high-speed, and bearing steels, as well as other high-alloy steels. The products are bundled after rolling.

One of the mills operated by SMI Steel (South Carolina, U.S.) was rebuilt in 1999. The project involved modernization of the four-strand continuous caster, the installation of a heating furnace with a capacity of 155 tons/h, and the construction of a continuous mill that includes 17 stands without housings. The stands are equipped with ac motors in order to perform the rolling operation without twisting of the semifinished product. The mill rolls the semifinished product while dividing it into four different strands, the end products being small-diameter reinforcement bars. After completion of the reconstruction project, the mill is expected to have a capacity of 720,000 tons/yr [2, 3].

The Argentinian company Acindar is now a leading producer of rolled sections in South America, thanks to the implementation of several programs aimed at improving the technology which is used and modernizing the rolling-mill equipment. Several new facilities were built at the factory of Villa Construction: a unit for the direct reduction of iron (by the Midrex process) with an annual capacity of 1 million tons; an electric steelmaking shop with three arc furnaces; two ladle-furnace units; two continuous casters with an annual capacity of 1.3 million tons; a section for conditioning semifinished products; a combination section/skelp mill with an annual capacity of 380,000 tons; a light-section/rod mill (600.00 tons/yr); a rod mill (150,000 tons/yr); a tube-welding unit that employs the EWR process (130,000 tons/yr).

The section/skelp mill has two three-high Kocks-designed blocks that include eight reducing stands. The mill also has a four-stand sizing block of the RSB type (Reducing and Sizing Blocks).

Reconstruction of the two-strand light section/rod mill, designed to roll wire rod and 5.5–16-mm-diam. sections – includes the installation of new cooling lines and allows the range of rolled products that can be made to be expanded to 25 mm. To keep the semifinished product from being twisted between the stands and thus having its cross-sectional dimensions destabilized, the plant installed two leader blocks of three-high 215 stands in place of two two-strand two-high stands. The new blocks were delivered by Kocks in assembled form (with the reduction gears in place).

The mill was rebuilt in stages. The mill was operated with one strand while preparations were being made for the upgrade and the equipment was being assembled. After completion of the first stage of the project, the mill was operated with two strands running at speeds of up to 80 m/sec. Rolling speed was increased to 95 m/sec after the finishing block was installed. This gave the mill an annual productivity of 645,000 tons/yr.

Improvement in the quality indices of the finished rolled product. Increase in usable output. The company Cascade Steel Rolling Mills (U.S.) began using noncontact laser-based gages made by Zumbach ODAC to measure the cross-sectional dimensions of rolled products (5–70 mm in diameter). The measurement system is insensitive to the composition of the material, the condition of the surface, luminescence, vibration, rolling speed, or the presence of fumes and dust. The measurement error is ±2.5 µm [4].

The company Mizushima (Japan) employs laser-based gages to determine the cross-sectional dimensions of semifinished beams in the mill line. These dimensions are measured with an error of less than 0.5 mm over a period of 18 sec [5].

The German firm SMS Demag has used a system that automatically controls product dimensions on a section mill owned by China Steel (in Taiwan). The hydraulic hold-down mechanisms can install new rolls either during pauses in operation or under load. The control system also maintains the prescribed forces between the stands of the mill. The measurement results are shown on the operator’s monitor and provide indications of axial displacements and excessive wear of the rolls or guides. The control system receives measurements of the height and width of the semifinished product every 2.5 msec [6].

Finishing stands Nos. 17 and 18 on a continuous mill at the Mizushima plant were replaced by a block composed of two four-high stands. The axial planes of the stands are separated from one another by a distance of 650 mm. The plant has installed a monitoring-control system to measure the cross-sectional dimensions of the semifinished products and adjust the rolls automatically when necessary. Universal stand No. 17, with a 1200-kW motor, was equipped with driven horizontal rolls and undriven vertical rolls. In stand No. 18 (with a 450-kW motor), the axes of the driven and undriven rolls are