

Omutninsk Metallurgical Plant
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Closed joint-stock company “Omutninsk Metallurgical Plant”

The 240 year history of Omutninsk Metallurgical Plant is described. Currently, Omutninsk Metallurgical Plant is a compact enterprise with incomplete metallurgical cycle and annual production volume of 180,000 t. The plant includes 4 main production facilities: steel-melting plant, long product rolling mill, steel shaped sections plant and elevator guide rails plant. Ready products of the enterprise comprise hot-rolled and calibrated shaped sections of high precision, cold-drawn and mechanically treated elevator guide rails. Considering remoteness of the plant from raw materials, the task for today is increasing volume of hi-tech products. Reconstruction plays a special role in solving this task. After successful finish of the first stage of reconstruction in 2006 (modernization of steel-melting plant), its second stage, including upgrading rolling production, is finishing now.

Key words: history, Ural region, iron and steel industry, section rolling, shaped products, elevator guide rails, reconstruction.

Omutninsk Metallurgical Plant is among the oldest enterprises of metallurgy in Russia. Its history extends back over 240 years. Omutninsk ferrum-producing and pig iron smelting plant was established within the period of Empress Ekaterina II governing by hereditary merchant and prominent manufacturer Ivan Petrovich Osokin. The official date of Omutninsk plant foundation is considered 1773 when the official permission for its construction was obtained from berg-collegium.

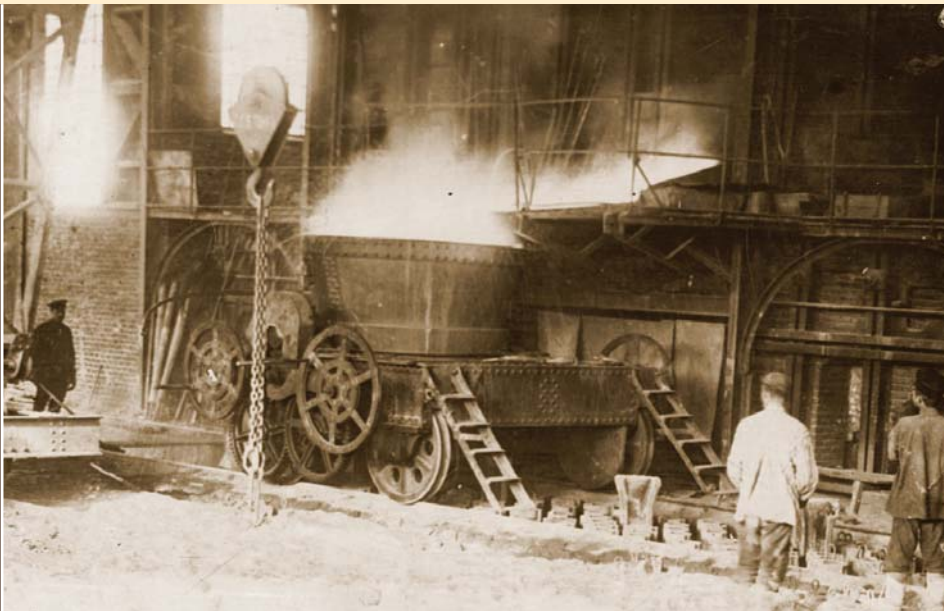
Initially the plant had only a ten-meter blast furnace and a refining plant; it included 6 furnaces and 6 ham-

mers. Air blowers (“bellows”) were actuated with a water wheel. A product range was not wide: pig iron was smelted in the blast furnace; it was forged in refined iron. Later the installation of a flattening mill allowed rolling of strip and band iron. Besides, the plant executed contractual work producing artillery shells. During 1781–1806, 43–60 thousand poods (1 pood is equal to 16 kg) of pig iron and 25–30 thousand poods of refined iron were produced annually.

First significant expansion of production volume took place in 1820-ies, when Gavriil Ivanovich Osokin, who inherited the plant, rent it out to the descendant of Swedish nobleman German Fridrikhovich Weimarn. The period of “Weimarn rent” expanded for 1819–1845. Within this period the load of the blast furnace increased a lot, and another refining plant was built.

Significant reconstruction of enterprise operation took place in the second half of XIX century, when new owners came to management of the plant. They were Pastukhovs, merchants from Yaroslavl. The period of their ownership extended till 1913, and it was accompanied with invitation of a galaxy of talented mining engineers as a management team. They were famous in the Ural metallurgical society.

In the second part of XIX century the plant produced both refined (till 1884) and puddle iron which was used for rolling sheet and section iron (tyre, band, strip, narrowband, round etc.). Both blast furnaces were upgraded in 1861, it made the base for increase of their daily smelting per each furnace up to 800–900 poods. One should refer to large plant enterprises of the second



Openheart furnace No. 1:
metal pouring in a ladle car mounted
in 1917 under management
of E. N. Barbot de Marni

half of XIX century construction of sheet rolling plant on the place of the former refining plant.

The important role in the plant development was played by Reingold Yakovlevich Gartvan, the mining engineer. By the project of Gartvan, mild steel with a wide range of profile sizes that has been produced in small batches, should have become the main product of the plant. Products of this kind were necessary for automotive and aircraft industries that have been starting up in Russia at that time. Exclusiveness of the products made Omutninsk plants a monopolist in the Russian market of metals.

The long product rolling shop, with a small-section mill 280 and billet mill 500 at the Omutninsk plant were rebuilt, the open-hearth plant with 15-t furnace was appeared, and also the electric station with 990 kW power was put in operation for the first time.

In 1915–1916 Omutninsk works, in addition to civil products, manufactured special steel for explosive devices, steel for ship chains, iron castings for trench bombs that were in great demand. In the meantime, connections with aircraft and automotive industries grew.

During the post-revolution time, in 1920–1930-ies, the plant management took a track on increasing and complication of rolled-products range produced in small batches. It is necessary to note that this trend of plant development remains up-to-date also at the present time. In the middle of 1930-ies, the specialists of this plant made the hardest operations on calibration of rolls and obtaining shaped sections which had been purchased abroad earlier. Among acquired profiles there were the profiles for reaping hooks, scythes, pear-shaped sections, spine-shaped and pendulum bob-shaped sections. In 1930-ies Omutninsk plant became a monopolist in production of a number of shaped sections in Russia.

Construction of the railroad Yar-Phosphoritnaya, liquidation of blast-furnace practice and construction of

another open-hearth furnace, construction and commissioning of a new electric station were the important events in the plant development in the period before the Great patriotic war.

During this war, in 1941–1945, the plant took orders to meet the needs of the front line. It produced 30 types of various sections and over 600 section sizes for defense enterprises. Simultaneously in these hard years the plant found enough forces to implement important measures on reconstruction which was held actually without interruptions in the production cycles. In the war period the new powerful electric engines were installed for three mills (450, 280, 550), as well as upgrading operations on semifinishing mill 500 and re-equipment of heating furnaces and 2 open-hearth furnaces were undertaken.

On October 31, 1962 the start-up of a new highly productive automatic mill 280 took place. After putting the new mill into practice, some operations on acquiring high precision steel shaped sections were executed. Within three following years, thermal calibration department was built; these facilities provided production of over 9,000 t of calibrated metal and over 1,000 t of cold drawn special shapes already in 1965. Based on proven technology organized on machinery and staff input, the plant received a possibility to construct a specialized production facility. The construction of cold drawing plant went very quickly: in 1969 its first stage came into operation, and in 1972 the same did its second stage. The rated capacity of the complex was 13,600 t of products per year. Already in 1973 production volumes reached 20,000 t, and simultaneously dimension range was broaden up to 300 types of sizes. In 1980-ies the range of products included over 500 items of cold drawn sections and 300 items of hot-rolled sections.

By the end of 1985 with putting into operation a new facility for production of elevator guide rails, annual output of the plant production exceeded 200,000 t.



Reconstruction of 500 rolling mill: preparing of basement and mounting of equipment



Steel pouring at continuous casting machine

In 1990-ies, during the time of market reforms in Russia, the plant managers not only protected the plant from bankruptcy, but also provided reliable foundations for its further development. So, in 1998 the first stage of plant upgrading started with construction of the new steel melting plant; that stage finished in 2006 with commissioning of a ladle furnace and the continuous casting machine. Within 1998-2005, gas pipeline was constructed, and it allowed transfer heat from black oil fuel to gas.

Since 2001 the managers of the plant have chosen the direction leading to creating a modern enterprise capable of producing complex cold drawn profiles of high precision, elevator guide rails, and hot-rolled profiles in a variety of steel grades with special physical and chemical characteristics.

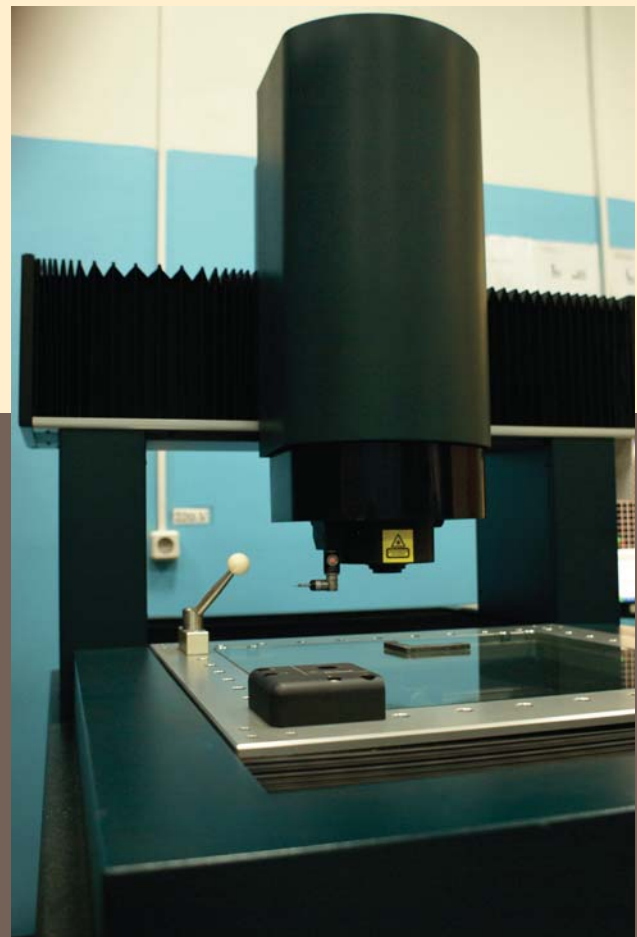
Currently, Omutninsk Metallurgical Plant is a compact enterprise with incomplete metallurgical cycle and annual production volume of 180,000 t. The plant includes 4 main production facilities: steel-melting plant, long product rolling mill, cold drawing plant and elevator guide rails plant. Finished products of the enterprise comprise hot-rolled and cold drawn sections of high precision, cold-drawn and mechanically treated elevator guide rails. Considering remoteness of the plant from raw materials, the task for today is increasing volume of hi-tech products. Reconstruction plays a special role in solving this task. After successful finish of the first stage of reconstruction in 2006, its second stage, including upgrading rolling production, was planned.

The main event of the second stage of the reconstruction was modernization of mill 500 that started in 2012. Modernization and transfer of profiles from the old mill 450 will make it possible not only to reduce consumption index at rolling, but also to increase precision of geometry, to provide the set complex of mechanical characteristics of rolling, to rise annual productivity to 120,000–150,000 t against 45,000 t of the old mill due

to automation of roll mills and replacement of manual work on metal edging.

Among the most recent upgrades in the rolling, one should mention construction and commissioning of mill 180 in 2009. It was aimed at producing of low-tonnage batches of small sections. The peculiarity of this mill is production output with small depth of decarburized layer which is less than 0.05 mm. Along with modernization of rolling facilities, a lot of attention is paid in the company to preparation of tools. So, in 2010 two high-precision EDM machines with precision of tools preparation $\pm 0,0015$ mm and roughness class 11 were installed in the mechanical and repair department to prepare drawing dies, various tools, gages. A new CNC turning machine for rolls preparation with precision grade of preparing forming rolls 0.01 mm in forge and turning department of mechanical and repair plant were put into practice in 2012. To provide high quality of a sections, successful modernization of tilting device in steel smelting plant has been inaugurated in 2012: as well, a modern hydraulic tilting device by Siemens VAI is installed.

Quality of products is provided with the integral management system operating at the plant, corresponding to the requirements of international standards



Laboratory of control testing



Finished products and dimension range
of Omutninsk Metallurgical Plant

ISO/TS 16949:2009, ISO 9001:2008, ISO 14001:2004. It is necessary to mention that in conditions of reconstruction the enterprise pays a lot of attention to environment protection, so pickling tanks in the technological operations of surface preparation were changed from pickling to shot blasting. Pickling tanks were eliminated in the plant of elevator guide rails (in 2009) and in the cold drawing sections (in 2012).

Specialists of the production control office and the central plant laboratory are working in the non-stop regime at improving of the acquired grades and acquiring new types of products. Among the latest works, one acquiring modified automatic steel AM12, AM14 (free of lead), should be mentioned; their qualities are not worse than those in Pb-containing equivalents, acquiring high-precision section from austenitic stainless steel, improvement of mechanical processing of materials for automotive components production. Production of about 8 new profiles takes place monthly at the plant, half of them are cold drawn sections with precision up to 0.05 mm. To save time and money for acquiring new types of products, the specialists of the plant employ modern means of technology development, such as sys-

tems of automated projecting AutoCAD, Kompas-3d, special engineering software based on FEM technique Deform 3d that are acquired to simulate the behaviour of metals under influence of pressure, temperature and mechanical treatment. The central plant lab is equipped with modern equipment to determine full chemical analysis, and also residual gases such as nitrogen, hydrogen and oxygen in steel. Besides the trivial trials in lab, conditions of control tests of the central plant laboratory, the trials on cyclic strength of material and crack resistance are conducted.

The products of Omutninsk Metallurgical Plant are known not only in Russia, but also abroad. Since 2007 Vol-Stahl company located in Dresden, Germany, is distributing products of the OMP on the European market.

Due to high professionalism of the staff, and their appreciation of their work the plant went through all trials of fortune and developed in accordance with requirements of the time. Traditions and experience accumulated through centuries, are successfully continued by contemporary plant workers allowing to see in the future with optimism.



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