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LASER TECHNOLOGIES FOR SHIPBUILDING AND ENGINEERING SECTOR

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The modern stage of engineering industry in the whole, and shipbuilding in particular is notable for starting implementation of technologies at major enterprises, which can substantially change the image of this previously rather conservative sector. Massive implementation of modern laser techniques is one of the ways to improve quality in shipbuilding and heavy engineering production.

JSC Shipbuilding & Shiprepair Technology Center is a leading design and technological center in the Russian shipbuilding. To support the process of equipping shipbuilding enterprises with complex lines, based on laser technologies, a Laser Shipbuilding Center was established, incorporating experimental facilities for research and mastering of technologies for laser cutting, laser and hybrid laser-arc welding, cladding, marking and labeling.

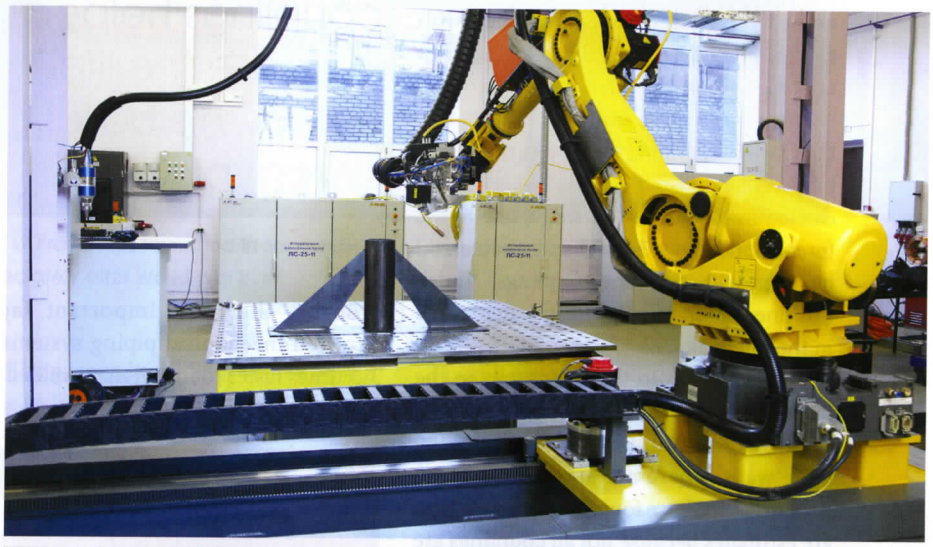
For more than 50 years, JSC SSTC (former PRC Ritm and FSUE CRIST) has been developing and supplying shipbuilding facilities with portal-type thermal cutting machines. The recent models are laser cutting machines with ytterbium fiber lasers made by RTC IRE-Polus (IPG). Portal-type laser cutting machines RITM are well known and proven in Russian market for their reliability and easy maintenance.

Portal system for laser cutting RITM-LASER (see Fig.1) is intended for cutting metal plates with size up to 2.5 x 10 m. The machine is equipped with 3.5 kW laser and gives a quality cut for plates up to 20 mm thick. The main advantages of the system are:

- precise parts cutting;
- option of automated marking and labeling;
- low operational costs and high reliability.

Apart from laser cutting machines, JSC SSTC is developing a number of program-controlled complexes for laser cutting and welding, designed for shipbuilding and marine engineering sector.

Fig. 1 – Portal complex for laser cutting RITM-LASER



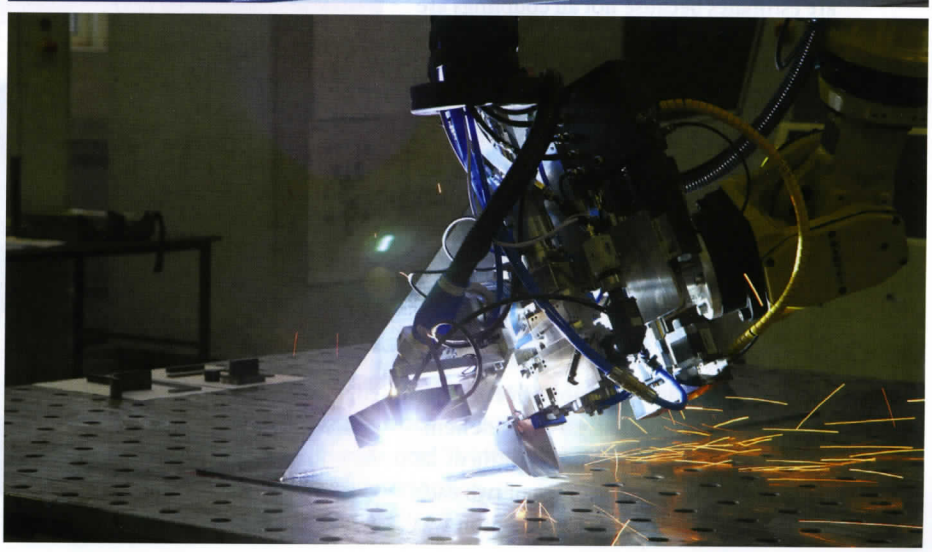


Fig. 2 –Robotized system for laser cutting and welding in various positions

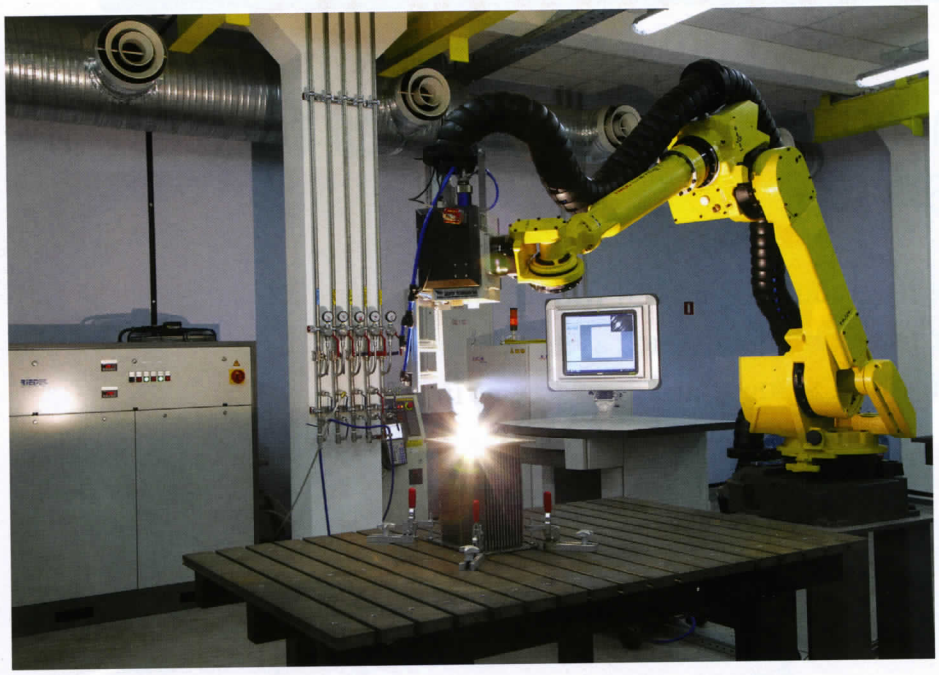


Fig.3 – Laser system Labyrinth

For complex-shaped welded structures, we have designed a robotized complex for laser cutting and welding in various positions (see Fig.2). The machine is unique due to use of 25 kW laser LS-25, one of the most powerful in Russia, and optical four-channel switch, allowing to use laser optical heads in turn for welding and cutting at the same machine, thus substantially reducing manufacturing time of welded structures.

With simultaneous reducing of welding deformations in 1.4 times comparing to conventional arc welding, use of laser equipment allows to reduce overall cost of hull construction by up to 30%, and to increase productivity of hull structures manufacturing more than in 1.1 times.

For laser welding in marine engineering, a technique and robotized program-controlled complex were developed (Fig.3), intended for welding thin-walled shells to solid structures, e.g. in marine pumps or valves, and for welding thin-walled tubes into tube plate (in heat exchangers). The system includes 8 kW fiber laser, welding robot, laser head for welding in places with limited access, and/or laser scanning head for welding of tube plates.

Main advantages of laser welding comparing to conventional arc techniques are high processing speed, better weld quality, minimal heat affected zone, low requirement of welding consumables and practical absence of welding deformations. Deformations are considerably reduced due to low heat input (several times less, than with conventional arc method).

JSC SSTC has developed a manufacturing technique of flat panels production up to 20 mm thick, based on laser cutting and laser-arc hybrid welding. The procedure of hybrid laser-arc welding of plates and webs with integrated grooving by laser cutting was approved by Russian Maritime Register of Shipping (see Fig. 4). This technique is implemented in automated line for assembly and welding of flat panels up to 12 x 12 m in size, designed and constructed in cooperation with IMG, Germany. The innovation solution is combination of grooving by laser cutting with plates welding by laser-arc method at one position, as well as solution of double-side welding of stiffeners with hybrid welding.

Although hybrid laser-arc welding is a complicated multi-parameter process, and its implementation at the shopfloor leads to certain technical problems and considerable investments, its effectiveness and vitality for shipbuilding production are proved.

Development and implementation of laser technologies allow to achieve a new level of productivity and manufacturing of structures in shipbuilding and heavy engineering.

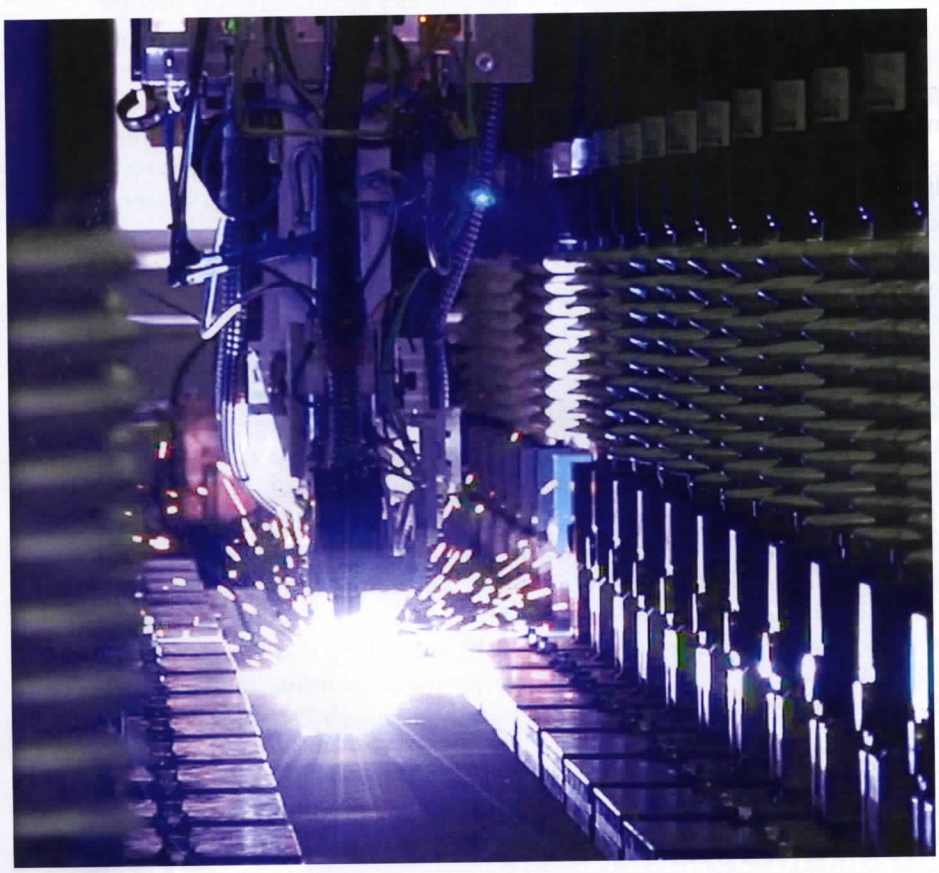


Fig.4 – Manufacturing of flat panels

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