MODERN EQUIPMENT FOR SHIPBUILDING

P. SEYFFARTH
Ingeniurtechnik und Maschinenbau GmbH, Rostok, Germany

Experience of IMG GmbH (Rostok, Germany) in development and manufacture of modern automated lines for cutting and marking of shaped sections for shipbuilding and related industries is described. The lines provide high precision of part manufacturing and processing speed, this allowing payback of their procurement costs within a year and a half.

Keywords: *plasma cutting, shipbuilding, shaped sections, automatic lines, equipment, marking, manufacturing accuracy*

Modern shipbuilding and other related industries require a high degree of automation. The known Ingeniurtechnik und Maschinenbau GmbH (IMG), Rostok, Germany, uses automated processes of cutting, welding, assembly and transportation. In addition to automated lines for manufacturing flat and bent panels, the Company is also equipped with lines for making micropanels, automated lines of shaped section cutting, cranes and other vehicles, as well as welding gantries to make butt and fillet joints. Starting from 2005, the Company pays a lot of attention to introduction of powerful industrial lasers. It is the world leader in the field of application of ytterbium fiber lasers in shipbuilding.

IMG fulfills orders of more than 50 large shipyards of the world (USA, China, Korea, Australia, Turkey, Canada, France, Great Britain, Finland, Italy, etc.). It is also known in Russian Federation. Here its equipment is operating in Admiraltejskaya Shipyard, Baltijsky Zavod, northern shipyards, etc. The first automated panel line was mounted by IMG Company in «Krasnoe Sormovo» Shipyard in Nizhny Novgorod in 2005.

One of the examples of the Company's modern equipment is a flow line for automatic cutting of shaped sections. Shaped section cutting line (Figure 1) with numerical program control (NPC) is designed for automated cutting and marking of shaped sections, which are used in shipbuilding, and includes the following elements: equipment for automatic material feed (accumulation tables for material with chain conveyors; roller conveyors; automatic processing devices for robotic plasma cutting of end cuts and

Figure 1. General view of NPC line for shaped section cutting

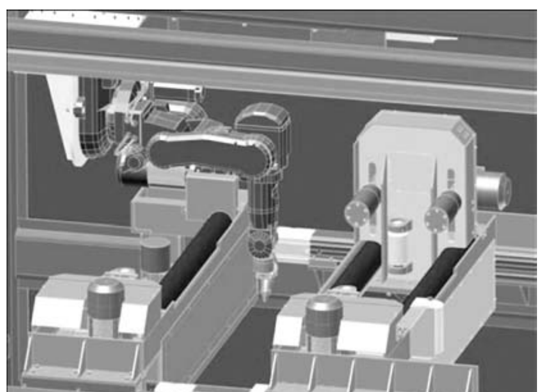

Figure 2. Appearance of the cutting device

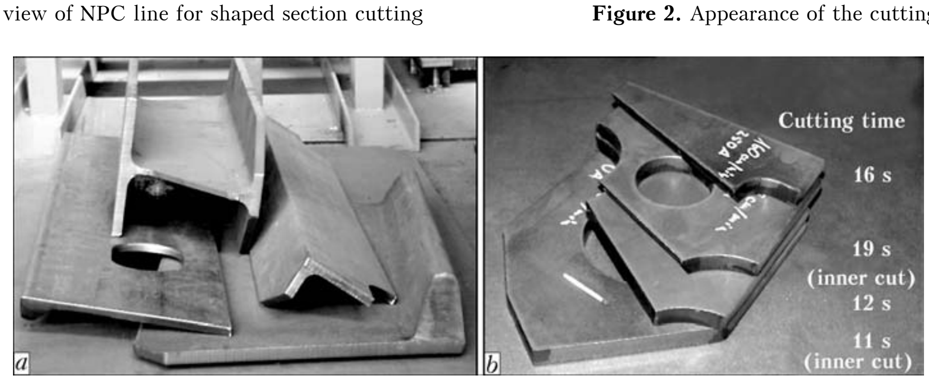

Figure 3. End cuts (*a*) and inner cuts of different types with or without edge preparation (*b*)

inner cuts (dales) (Figures 2 and 3), as well as alphanumeric marking of blanks (Figure 4).

Equipment for shaped section sorting after cutting includes a manipulator for blank warehousing, sorting gantry for loading 3 to 12 m sections and cartridges for finished shaped parts. Operation with a pivot arm and sorting gantry is more adaptable to fabrication and faster compared to bridge crane.

Equipment for development of control programs with NPC ensuring automatic mode of operation of shaped section cutting line (Figures 5–7) is divided into hardware (programming, file storage and program starting) and software (generation of programs of cutting with NPC and line operation).

NPC line for cutting shaped sections is complex equipment for making parts from shaped sections. Interfacing with shop sections in the plant is achieved as follows. At the input information is received about the shaped sections supplied for cutting (transmitted from the plant system of production planning); about geometry of pipe section cutting (received from CAD system); about shaped blanks used as initial material for shaped section cutting; about empty cartridges for finished shaped sections after cutting. At the output information is provided about cartridges filled with shaped sections for their transportation, as well as shaped section types made by cutting (feedback to production planning system).

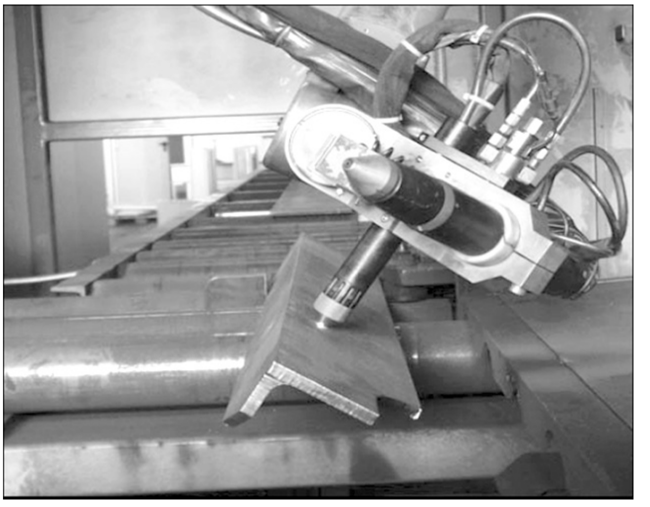

Figure 4. Marking by a plasma or jet method

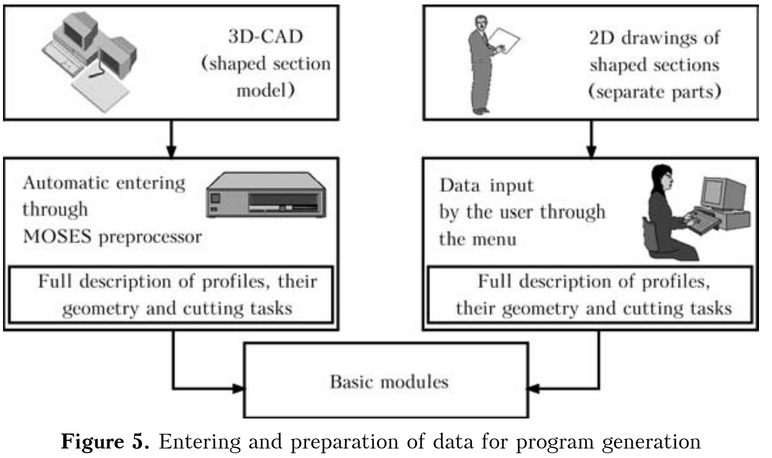

Figure 5. Entering and preparation of data for program generation

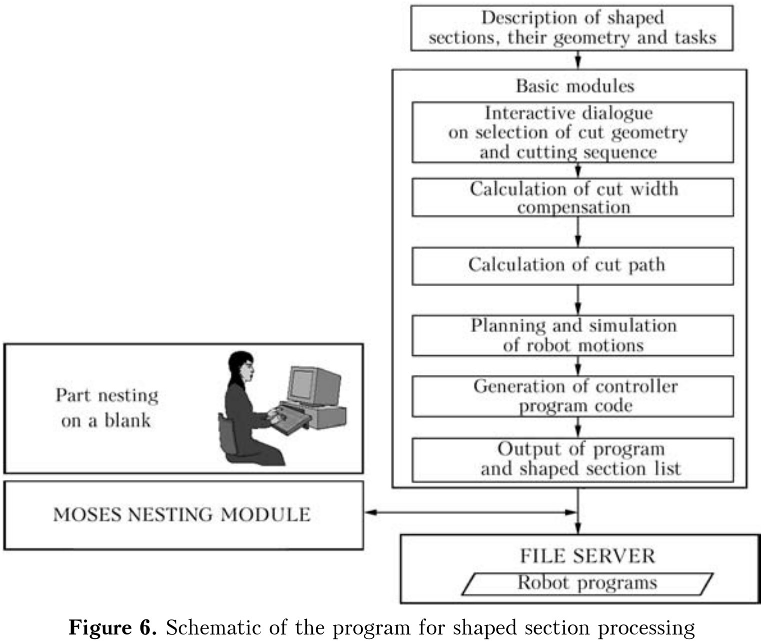

Figure 6. Schematic of the program for shaped section processing

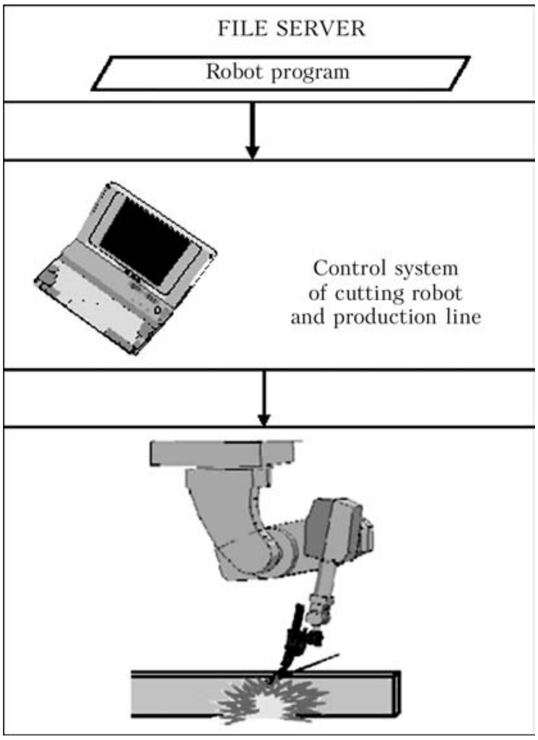

Figure 7. Use of cutting programs

Shaped section processing line (Figure 8) fulfills the following main functions: laying of shaped section stacks or individual shaped sections on a chain conveyor; intermediate storage of blanks on the chain conveyor and feeding them to charging roller table; blank feeding to cutting chamber; automatic fulfillment of the working task of production preparation department in the cutting chamber: cutting along the length (end cuts); cutting out dales; application of alphanumeric marking with paint using a marking device; automatic transportation of shaped sections to discharging; shaped section sorting by cartridges with ridge-like posts in the pre-set technological sequence.

Operator (or two operators) using the crane available in the shop, moves the body of shaped blanks into the line working zone onto a chain conveyor. Conveyor design facilitates for the operator the task of laying and positioning the shaped sections. At laying care should be taken to keep 200 mm distance between them. After laying the shaped sections, their fully automated processing starts: feeding individual shaped sections from chain conveyor to hoisting conveyor, and then to roller conveyor, along which the section moves to the cutting chamber; intermediate accumulation of shaped sections on the roller conveyor and their subsequent transportation to the cutting chamber; shaped section feeding by roller conveyor located in front of the cutting chamber and its fastening for processing, shaped section position being controlled by a device of length measurement located in front of the cutting chamber; if required the measurement system issues a signal on position correction using a cutting robot; making end and inner cutouts in the blanks using robotic plasma cutting (see Figures 2 and 3), during which the shaped section remains in the cutting chamber in the fixed position; marking of shaped blanks before the cutting chamber by the jet method (see Figure 4); displacement of shaped section to the loading table for approximately 500–3000 mm. Finished parts can be dumped or loaded manually, and they can be placed into a box by a rotating beam crane; they can be placed into a box by the shop crane, or transferred to the grinding section. Shaped section transportation for approximately 3000 and 13,000 mm is performed by a transportation roller conveyor and chain conveyor, which also has the role of intermediate accumulator. Transportation by the sorting gantry, shaped section laying into cartridges and their transfer to the grinding section can also be performed. Then shaped sections are laid into cartridges by the shop crane and transferred to the grinding section, the shop crane requiring availability of a magnetic crossbeam.

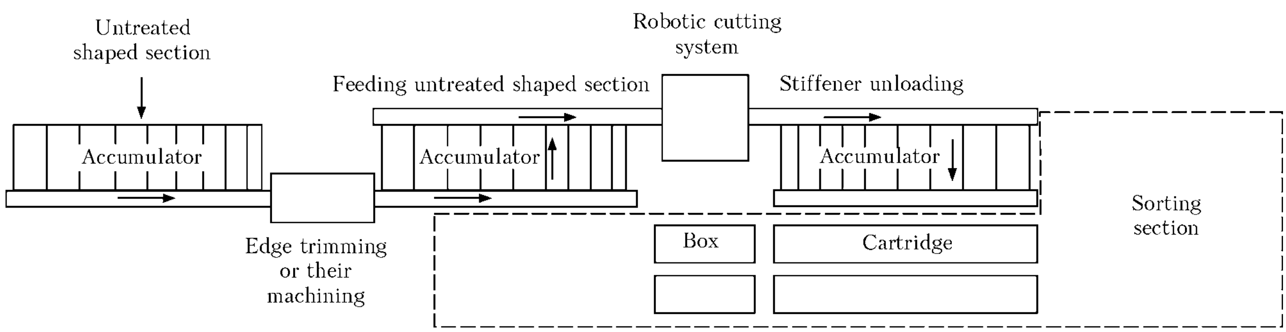

Figure 8. Diagram of shaped section treatment line

Thus, accuracy of part manufacture, and their processing speed many times exceed the technologies of shaped section preparation used so far. This allows eliminating the bottlenecks in the technological process. Note than owing to a high efficiency of automatic cutting line the investments into its introduction are paid back within a year and a half.