



## CARPENTRY CNC PRODUCED BY "FANUM" – INNOVATIVE CONSTRUCTION

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### Abstract

*Centre carpenter, is now a CNC machine dedicated to the production of prefabricated wooden structures. The machine processes the only elements with straight axis and dimensions usually in the range of  $4 \times 4$  cm to  $40 \times 60$  cm. There are several producers of CNC machines like for example: Hundegger, Weinmann, Essetre, Winmann, Schmidler. Their products differ for example in price, production speed, possibilities and dimensions of machined elements and construction. Using some simplifications one can distinguish two basic types of machines.*

*One can distinguish two basic types of machines which differ in construction: FANUM produces equipment which two-head version is called CNC "Kappa" center. It enables very precise machining of wood elements together with maximal optimisation of working time. The advantage of Kappa is portal construction which gives very wide technological possibilities. It is equipped in two supports /Machining head: 1-spindle+sawing aggregate/ with additional peavy.*

**Key words:** *carpentry CNC, Kappa, two slides, spindle, sawing unit,*

### INTRODUCTION

Carpenter centre is a CNC machine dedicated to production of prefabricated units for wood constructions. Usually such a machine treats elements which are straight and have dimensions from  $4 \times 4$  cm to  $40 \times 60$  cm, the machine consists from three parts: feeding table, machining set and delivery table.

The machine performs processing carpentry involving cutting, milling and drilling. Treatment are carried out with tools mounted in units called parts machining. Basic tools are: circular saw a large diameter end mill, a large universal milling and drilling (Kopkowicz 2009, Krüsimatic).

Several years ago carpentry centers were seen as unnecessary and unprofitable investment. Managers considered that so expensive machine with low cost of work will never pay back. With time passing showed that sceptics were wrong and investment in such centers were right decisions and what is more very profitable. (Bekas 2015) They facilitated quick accomplishment of for example carpentry couplings. It was a result of development of CNC construction as well as coming into being of software for projecting of wood constructions and simultaneous numerical control of processing machines. Such software enabled elimination of mistakes in project stage. The most modern CNC machines working in Poland produce large size elements for wood house construction, carports, summer

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houses, garages, wood constructions for roofs, elements of bridges, rafter framing and so on. (Grzyb 2007, Walicht 2010, Wieloch, Porankiewicz 2010.

## CARPENTRY CENTER – THE CONSTRUCTION OF MACHINE

There are several producers of CNC machines like for example: Hundegger, SCM, Essetre, Krüsimatic Abbundcenter G1, Schmidler, Weinmann. Their products differ for example in price, production speed, possibilities and dimensions of machined elements and construction.

Using some simplifications one can distinguish two basic types of machines.

- Classic concept - construction project of carpentry center assumes installation of many independent aggregates along working series. Each aggregate has its own independent drive. The advantage of such arrangement is big output of the machine. Big dimensions are disadvantage which induces large production surface and impossible or very difficult development of the machine.

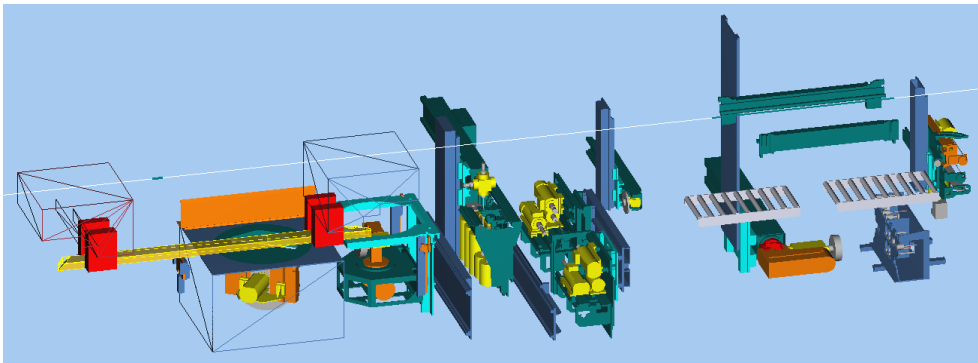


Fig.1. Classic concept of carpentry machine - Hundegger K2

- "Robot" concept - is limited to one or two working arms situated on machine's body. Electrospindles enable exchange of tools in cartridge. The machine is compact and easy to develop. Time of tools exchange prolongs machining time and limits its output. The concept of "Robot" carpenter machine is shown on Fig.2.

On the basis of "Robot" concept FANUM introduced a new article defined as automatic carpenter center Alfa. Its two-head version is called CNC "Kappa". This is a new concept in the market which enables very precise machining of wood elements at maximal optimisation of working time.

New machining center produced by FANUM is equipped in two supports / Machining head: 1- spindle + sawing aggregate / with additional heavy. An assumption was taken that respective operations - all machining actions will be performed by spindle which can work in each needed plain.

The machine without operator shuffles a beam into the working of two buckets which are numerically controlled. These buckets precisely control relocation of the element regarding to longitudinal axis of the machine. CNC is also equipped in dedusting system for sawdust and chips and has also conveyor for waste.

The control system of the machine may use ready made projects of rafter framing using their geometry for configuration of machining process for individual elements. CNC

carpenter centre cooperates other programmes destined for carpentry works like SEMA and DIETRICHS.

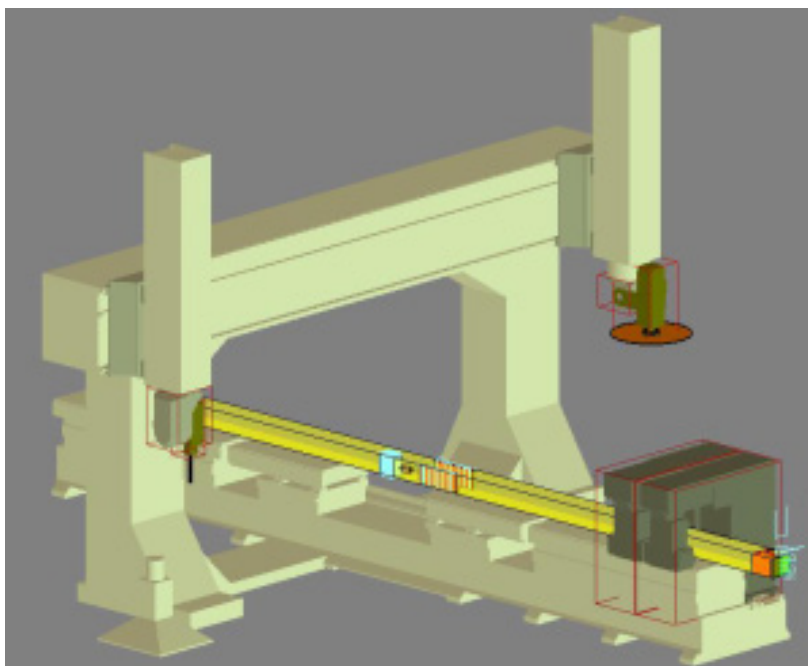


Fig.2. The concept of "Robot" carpenter machine - the example of the construction - the company FANUM "Kappa"

New carpenter centre KAPPA produced by FANUM from Wielopole Skrzyńskie which is the result of implementation of innovative technology:

- Two working heads rotationally-tippable, independently fixed on different supports, moving crosswise to working table and cooperating with automatic system of tools exchange.
  - ✓ Unilaterally braced, rotationally-tippable, drilling-milling working head equipped in additional external bearings; it is destined for all types of carpenter operations like: moulding of shapes, contours, pins, nests or drilling.
  - ✓ Rotationally-tippable cutting head equipped in disc saw of max. diameter  $\varnothing$  650 mm. (Fig.2,6).
  - ✓ Usage of two heads results in substantial limitation of machining time, especially when we have frequent alternating operations of cutting, milling or drilling (no waste of time for tools' changing).
  - ✓ Automated up and down-loading parts
  - ✓ Beds with two mobile carriages (fig.5,6),
  - ✓ Heavy aggregate (option) enabling machining from any side
  - ✓ Disc-store for tools limiting time needed for change of tools
  - ✓ Progressive, central lubrication system
  - ✓ System of electronic side guides of manipulator connected with interpolated machine axis.

- ✓ Annular converter of orientation for read out the position of rotary axis (direct read out of supports position)
- ✓ Interpolated machine axis company YASKAWA production,



Fig.5. View of downtown carpenter "KAPPA": portal, spindles, trucks mobile systems and for discharge

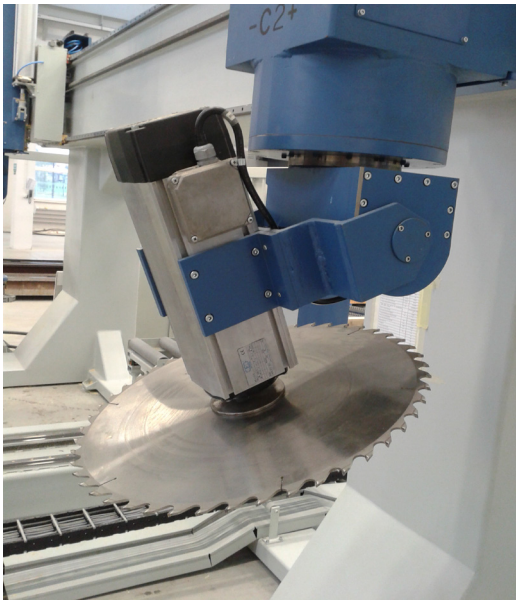


Fig.6. Rotationnal-tippable cutting head equipped in disc saw

Electric control system of the machine tool is equipped in modern function "Safety Power" which toggles it into sleep state (Stend-By) which results in energy save from 10 up to 15%.

New machining center is numerically controlled in 11 axis. In described machine tool radial forces influencing transmission and assuring rigidity of construction and failure-free work of head, were significantly reduced.

The risk of break-down of the machine was eliminated via possibility of grease distribution depending on demand of a given assembly.

Automatic assessment of patency of the whole system allows detect congestion of a given channel via information displayed on the operator's screen.

The time needed for attendance and conservation was limited substantially which in case of machining centers is very important matter influencing continuity of production process.

Reliability of electronic side guides of manipulator system causes discrepancy elimination between read and real value which has great influence on precision of machining, essential from the point of view of further constructional works. The usage of rule excludes the risk of collision between working parts of machine. Source code for such machine is BTL in standard 10.3. Files in described standard are generated by all systems that matter in the market CAD/CAM destined for projecting wood constructions (DIETRICH'S, CADWORK, SEMA, etc.). BTL files are imported for VisioBTL software, worked out by FANUM company. VisioBTL software enables managing of prefabricated units, generativity of tool tracks and simulation of production process.

The carpenter center is equipped in module of remote control and diagnosis via the Internet which enables quick recognition of problems and quick reaction of service team in emergency situations.

## SYSTEM OF BEAMS' DISPLACEMENT

Each machined element is relocated along Y axis by two digitally controlled trolleys. Two mobile carriages as in other solutions (equipped in system of clamps, rolls and catchers guarantees clamp and support of prefabricated element in at least two points in such a way that most of vibrations are eliminated. Use of servo-motors with high power and planetary gears for linear power feed of carriages results in their big acceleration and velocity which substantially shortens time of dislocation of clows.

The concept of construction of carpentry center enables fully automatic machining of elements of different length but not shorter than 800 mm.

On CNC market this construction can replace very expensive carpentry centers of other brands.

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