

CONSTRUCTIVE AND TECHNOLOGICAL POSSIBILITIES OF ENLARGING THE MACHINE TOOLS PRODUCTION FOR THE ENDOWMENT WITH 5 CNC AXES AT SC STIMIN IND SA ORADEA

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Abstract

The simultaneous milling on 5 axes ensure for the three-dimensional complex parts with a productivity with 50% higher than the machining on 3 axes, very often used for this kind of procedures. In other words, even if the investment costs for this kind of machining center are high, a machine like this can reduce considerably the production costs.

In the area of the CNC machines it was developed and produced the group of machines FPH 800 CNC, FPH 1000 CNC, FPM 1000 CNC, HMC 1 – 1, HMC – 2, CPAF 130.

Keyword: **Five axes machining**

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Figure 1,[1]

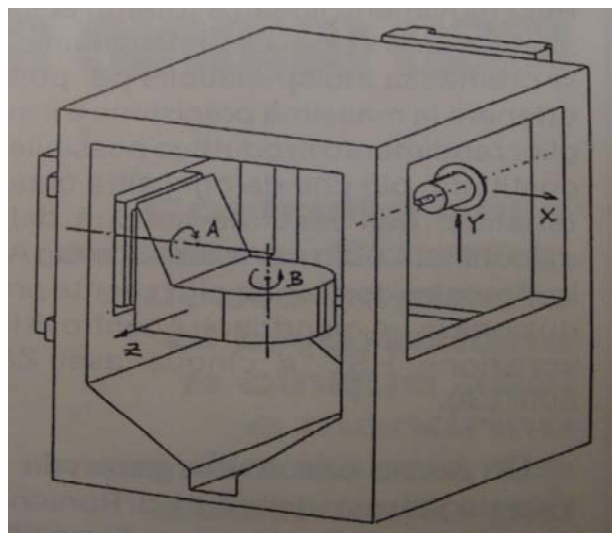


Figure 2,[2]

The dynamic of the cutting tools, the increase of the requirements regarding the machining possibilities and the regulations regarding the environment, represent the start of the development in the machining technologies area (figure 5).



Figure 3,[1]



Figure 4,[3]

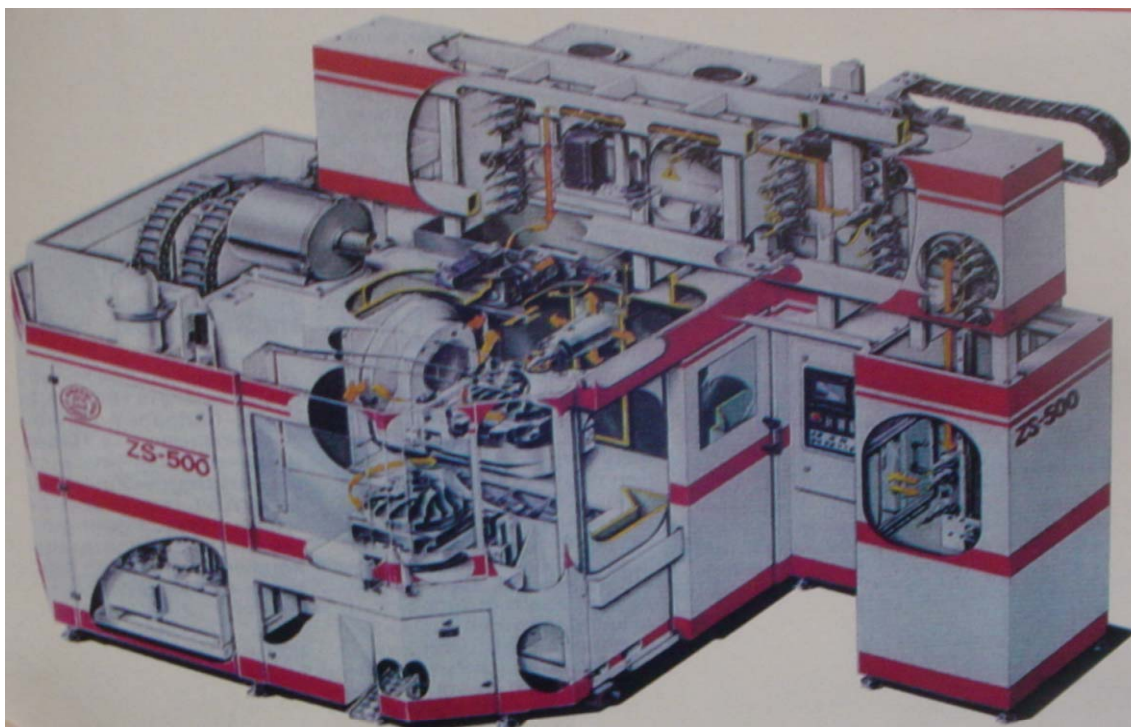


Figure 5,[2]

The machines that were produced until the early '90s do not satisfy in all the cases the technological modern necessities of machining. In order to maintain its position on the market, SC STIMIN IND. SA has chosen two development possibilities. The first possibility followed the reconstruction way of the production schedule, to produce conventional machines and the second one was to develop the production of CNC machines. The company has chosen both ways, according to the necessities on the external market. Among the CNC machines, there were developed and produced the group of machines FPH 800 CNC, FPH 1000 CNC, FPM 1000 CNC, HMC 1 – 1, HMC – 2, CPAF 130.

The whole group is composed by modules and in this way by their combination, according to the needs of the client, it can reach a high constructive variety. The milling

head makes possible the adjustment of the position of the two inclined surfaces at 45° found face to face. By the combination of the separate rotation of these separation surfaces, the milling head can be adjusted in the right positions. Between 2001 – 2002 there was accomplished a hydraulic milling head CAH – ISO 50 having automatic possibility of positioning the horizontal-vertical milling head and an automatic indexing head 72+72 positions in experimental stage on the CPFU 71 machine.

The high concern of the SC STIMIN IND SA ORADEA top management given to the technical progress and also the love for the mechanics and high professionalism helped the plant to produce very complex machine tools.

From the concept of gear box with several gears (heat source and noise) they passed to the use of planetary adapter (having a small weight and being silent) [5].

The movement of the main shaft is transmitted by a toothed belt at a constant power, during a silent functioning and without shocks.

The use of chipping special tools that allow chipping regimes with high speed rotation has led to the reconstruction of the bearing of the main shaft concept.

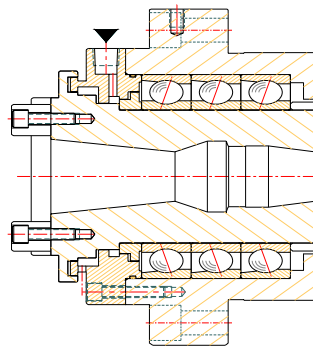


Figure 6

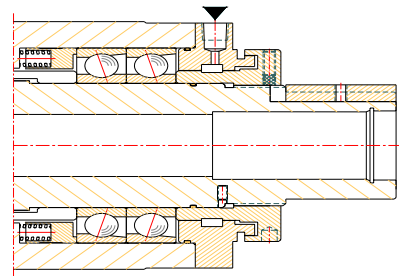


Figure 7

The high precision bearings block, for the front part of the main spindle (in the area of the ISO taper), is cooled down by a forced oil circuit (figure 6).

The pressuring of the high precision block, in the back of the main spindle is made using cylindrical helix springs of compression, in order to avoid an over pressure given by the thermal dilatation (figure 7).

By the use of ball screws with high range 20-30mm/min and also guides with rolling rolls (GRD) the linear movement speed on the three axes can be of 15000 mm/min. for higher speeds (30000mm/min) there were used linear guide ways.

The use of the CNC tilting tables forced SC STIMIN IND SA to produce machine tools with milling on simultaneous 4 axes(3 axes machine+1 axis tilting table);(figure 8).



Figure 8

The objective need to produce in short time and with high productivity led to a fast evolution of the structural concept of the machine tools with 5 axes (figure 12); (figure 13).

At a single settlement of the processed part the machining can be realized on the 5 fronts of the part, reducing the time needed for repositioning and the deviations that can result at each repositioning of the part..

At the machine on 4 axes (3 linear axes the machine +1 axis tilting table) will be introduced a tilting head (axis A), this being adapted on machines type FPH. Another system for the use of 5 axes is the inclusion on FPH, FPM (with 3 axes) machines of a tilting table with axes A and B integrated (table MRI- 630 2CNC). (figure 9); (figure 10).



Figure 9,[3]

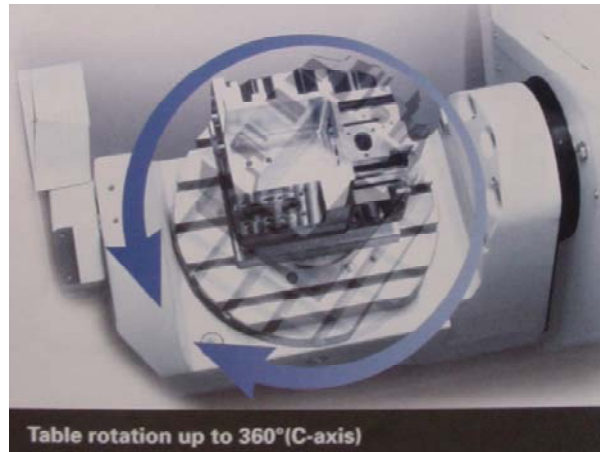


Figure 10,[3]

In order to use milling machines with two CNC axis at SC STIMIN IND SA can make a difference at the used machines as follows:

-the heads with 2 CNC axes for power of 10kw can be adapted to the machines type FPM,FPH (HD 320 -2CNC milling head); (figure 11)

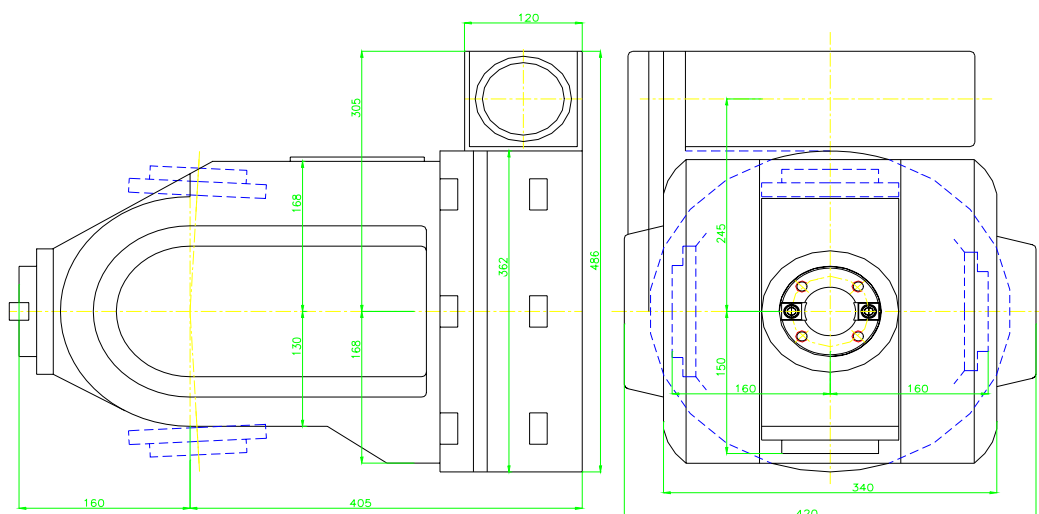


Figure 11,[4]

- Milling heads with two CNC axes for powers of 15kw can be adapted to the machines type AFP 130,HMC 1-1 (HD 420-2CNC milling head).



Figure 12

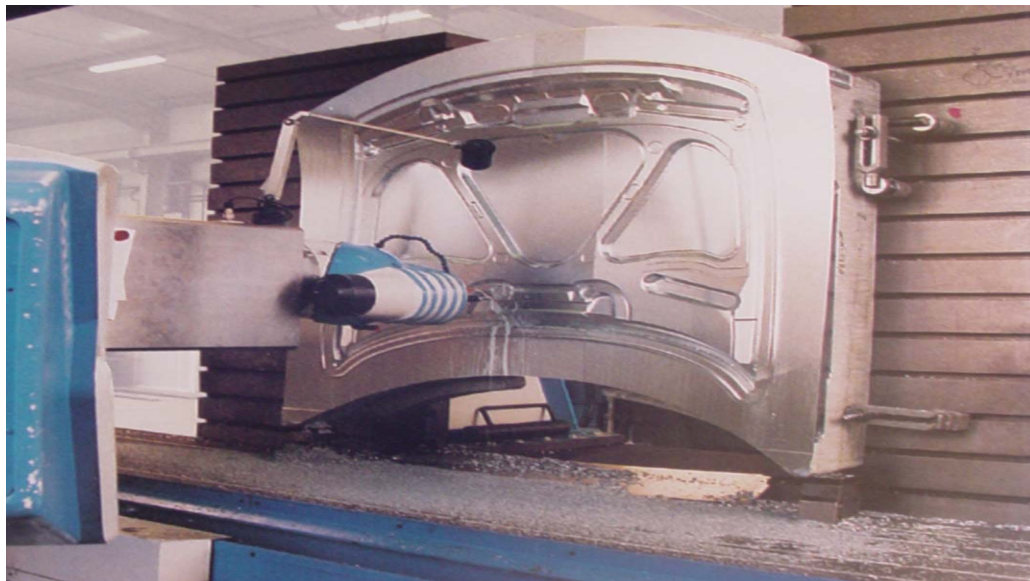


Figure 13

Conclusion: the present paper is subject of a Ph.d thesis of the author.

BIBLIOGRAFIE:

- [1]- Catalog HAAS: Haas Automation-2004
- [2]- Catalog TECNOLOGIE MECCANICHE-Italia -2002
- [3]- Catalog MAZAK-Japonia 2006
- [4]-Ganea M.-Mașini și echip.pentru prel.în 4-5 axe CNC,Ed.Univ.din Oradea,2004
- [5]- T&T-Revistă lunară de specialitate,București,colecția 2006-2007