

ABOUT THE 5-TH AXIS "A" AT THE MACHINE TMA AL 550

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ABSTRACT

Keyword: *Five axes machining.*

The machine TMA AL 550 is a horizontal machining center with the pallet of 500 mm, machine sponsored by the Italian partner Tacchella Machine.

The University from Oradea, Faculty of Mechanical Engineering (IMT) want to perform on owns forces the retrofitting activity, in order to modernize the machine TMA AL 550.

This machine actually is equipped with three and half axes (three linear CNC axes and one rotary PLC axis by indexing).

By retrofitting the machine will be modified on the mechanical system, in order to be able for five axes machining, and on the electric part with a new CNC unit Heidenhain TNC i530 also for five axes machining.

The authors of the present paper work show the possibility, that in the next few months, the machine to be able to arrive at the requested level for one modern laboratory of machine tools and flexible systems at Oradea University.

INTRODUCTION. THE ACTUAL STAGE.

First, a little bit about the actual Italian machine, recently received at Oradea University, it can see in the next figures some general information as follows, [2]:

- The general view of the basic machine (**fig. 1**), the machine TMA AL 550, as horizontal machining centre with 3 linear CNC axes X, Y, Z and one PLC axis as rotary indexing table (in the figure mentioned as B, even we talking about of indexing by Hirth coupling);
- The ATC unit with tool magazine and ATC hydraulic manipulator at 90 deg with variable gestion (**fig. 2**);
- The APC unit with the rotary manipulator for the pallet of 500 mm;
- The machine controlled by the CNC unit Sinumerik 3M;
- Some functions for the machining center level installed on the basic machine (chip conveyor, machine guarding, telescopic guide covers, lubrication installation, hydraulic installation, spindle orientation, hydraulic tool releasing from the spindle, two speed range by hydraulic cylinder, air blast trough the spindle);

DESCRIPTION OF THE NEW STAGE

The machine will be modified in the next few months, in order to be equipped with five axes machining and some functions for the FMC level (Flexible Manufacturing Cell) by retrofitting activity at Oradea University.

The level of five axes machining means:

- the transformation of the actual rotary index table to continuous feed rotary table as B axis;
- the second rotary table as C axis, disposed over the basic rotary table as detachable unit together the pallet by the APC function (**fig. 3**);
- the new CNC unit TNC i530 Heidenhain with five axes machining, instead the actual CNC Sinumerik 3M with three axes;
- two supplementary AC servomotors and drives in the electric cabinet for 4-th and 5-th axes and all the electric modifications.

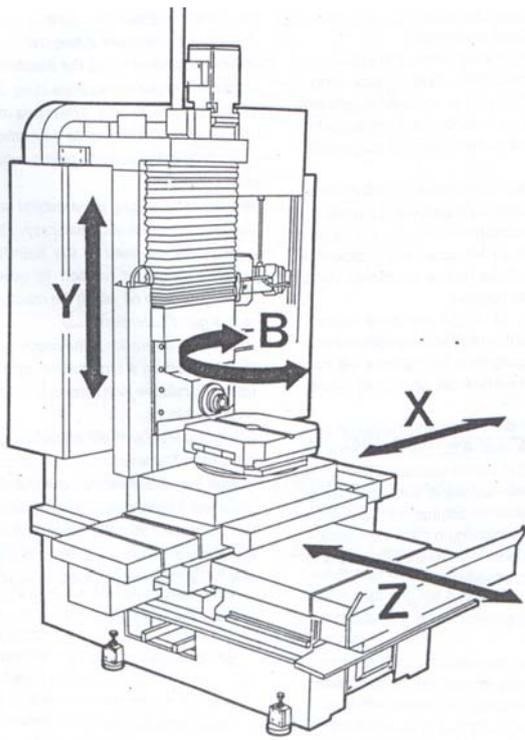


Fig. 1 – TMA AL 550 – general view

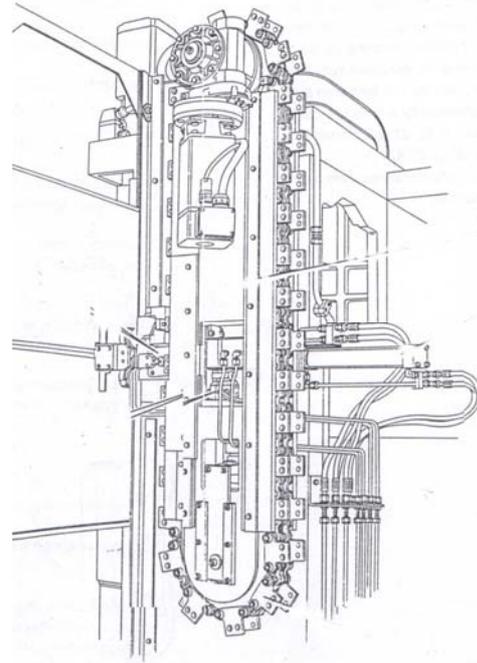


Fig. 2 – ATC 34 chain type

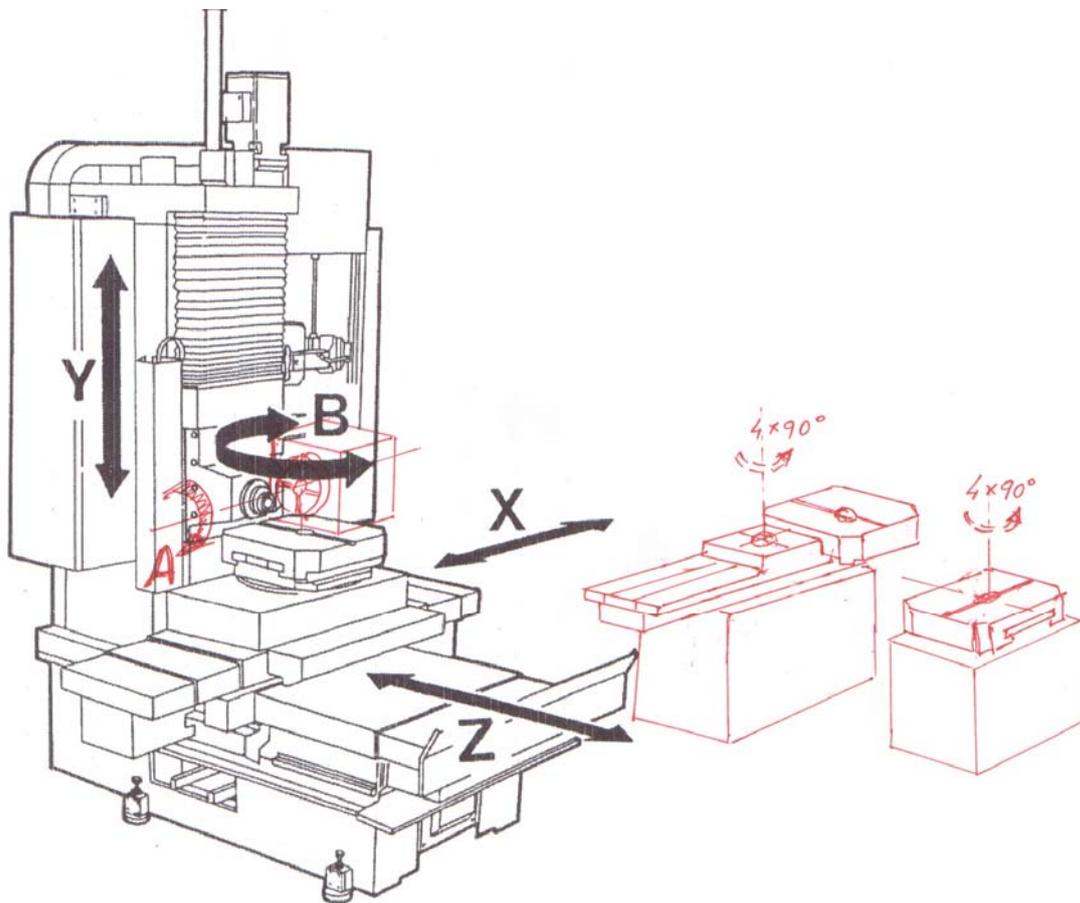


Fig. 3 – The machine with APC and 5 axes

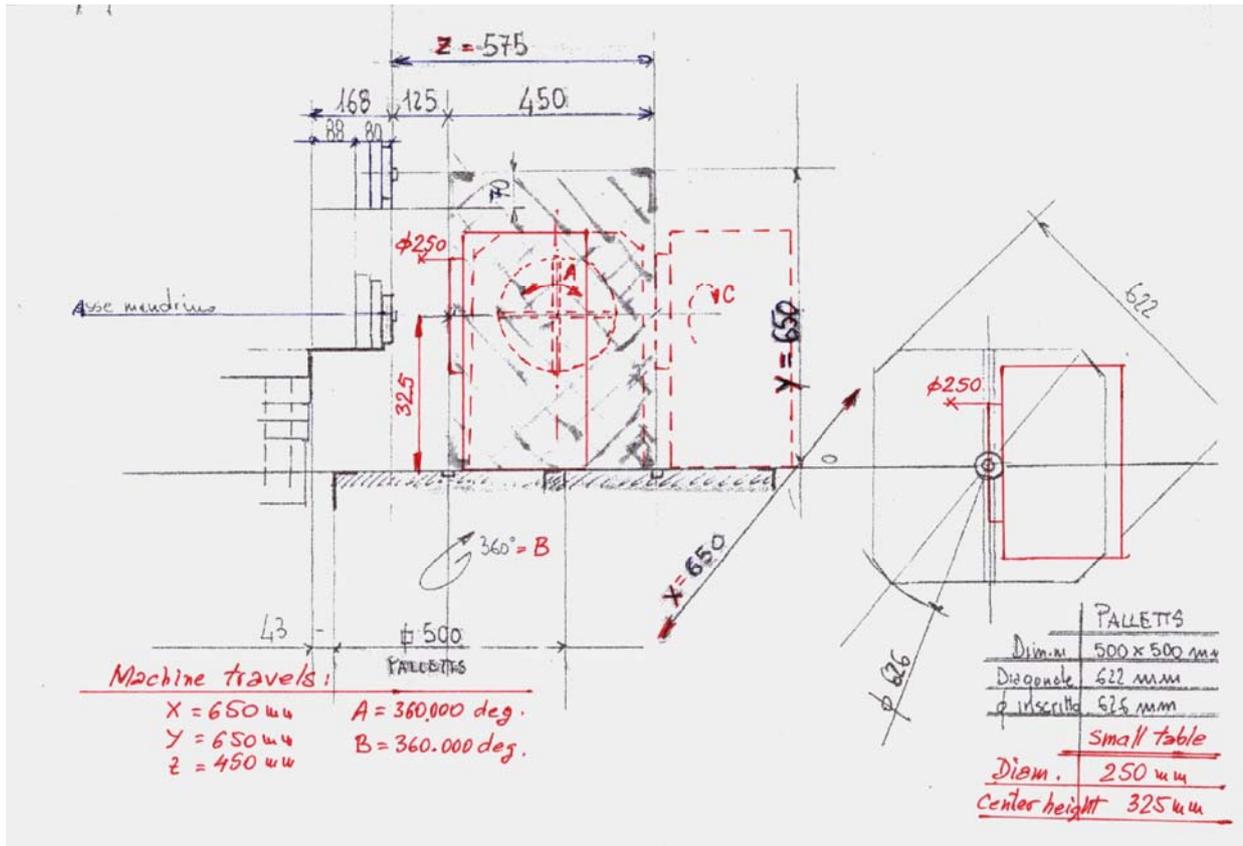


Fig. 4 – The working space at five axes machining



Fig. 5 – The rotary-tilting table with 2 CNC axes, as detachable unit

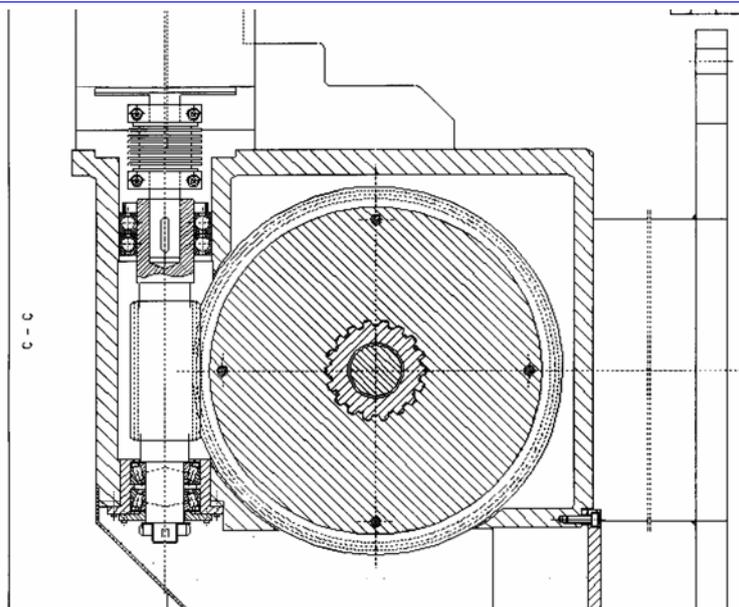


Fig. 6 – The Duplex worm solution



Fig. 7 – Small table 250 dia.

In the **fig. 4** it is showed the working cube space for the five axes case (with both rotary tables in position). That means the machine capacity for the largest part is the dimensions of 650 mm in diameter and 325 mm in length.

In the **fig. 5** it is showed the variant of the rotary-tilting table from Italy, as detachable module under the same 5 axes CNC unit. This table has two CNC axes: A-tilting of 150 deg, B-rotation of 360 deg, permitting large possibilities for the technological applications. This table mounted on the pallet, in order to be called by APC in the case of five axis machining. In this variant the actual basic index table of the machine remain unchanged by Hirth coupling and the machine will be equipped with the second table option, in order to obtain the five axes machining possibility on TMA AL 550 machine.

In the **fig. 6** it is showed the Duplex worm solution for the rotary feed mechanism at the secondary machine rotary table, with the backlash mechanism, **[1]**, having 250 mm diameter as in **fig. 7**.

CONCLUSIONS

The machine retrofitting is a complex action in order to touch the planed objective that means: the five axes machining and flexible cell functions.

Regard the fifth machine axis, the authors of the present paper work propose the detachable table solution, as in the over mentioned description, because it is a modular construction and permits a flexibility in the machine using.

By the using of the detachable rotary CNC table as fifth CNC axis ("table over table" system), it is possible to work in five axes with the first pallet, or to work as horizontal flexible cell in 4 axes with the second pallet.

On the other hand, the modular construction has some advantages in the machine building and also in the machine using.

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[2] – *TMA AL 550, Machine instruction manual, Italy, 1996;*