

SOLUTIONS FOR THE 4-TH AXIS "B" AT THE MACHINE TMA AL 550 FROM INDEXING TO CONTINUOUS AXIS CONTROL

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Abstract

Keyword: *Five axes machining.*

INTRODUCTION

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 action is very complex and it need of technical potential. This objective can be successfully assured by the help of the specialized factory Stimin Oradea, which have the capacity in this field.

The machine TMA AL 550 is a horizontal machining center with the pallet of 500 mm, machine sponsored by the Italian partner Tacchella Machine. 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 to work in five axes, and on the electric part with a new CNC unit Heidenhain TNC i530 for five axes machining.

ABOUT THE ACTUAL MACHINE

The machine TMA AL 550 is a horizontal machining center with the pallet of 500 mm, machine, having all functions for the machining center level. This machine actually is equipped with three and half axes (three linear CNC axes and one rotary PLC axis by indexing). The machine have also ATC (automatic tool changing system) chain type with 34 tools and hydraulic ATC manipulator, APC (automatic pallet changing system) with two pallets and rotary manipulator, different specific functions for the level of machining center, CNC equipment Siemens Sinumerik 3M.

One picture of the basic machine is showed as in **fig. 1**.

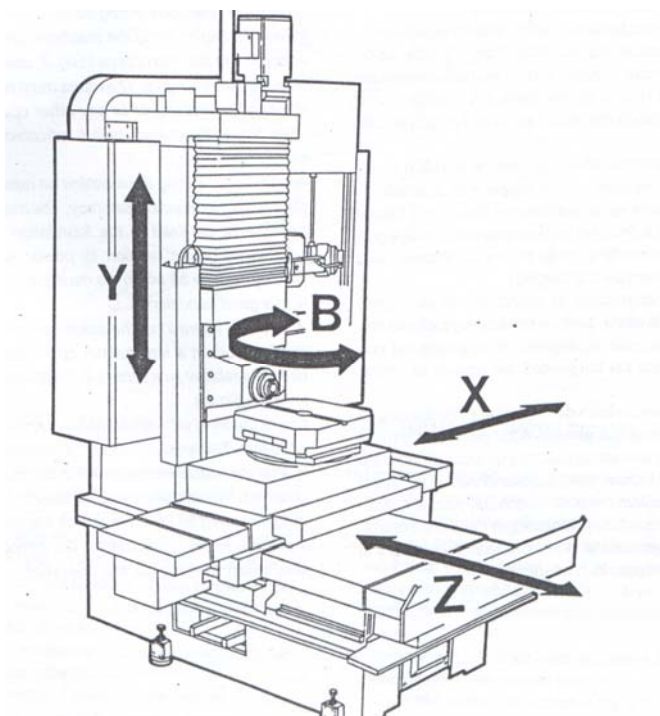


Fig. 1 – The basic machine TMA AL 550 with three linear axes and half rotary axis B, as PLC controlled

The machine TMA AL 550 is actually equipped with automatic tool changing function (ATC), that means one tool magazine chain type, one hydraulic manipulator with double arm at 90 deg, for variable tool gestion in the magazine, controlled by the CNC unit.

Also, the machine is equipped with automatic pallet changing function (APC), having one rotary pallet manipulator with two pallets for the loading-unloading on the working machine table.

The machine is also equipped with linear scales on the X, Y, Z axes, as independent CNC controlled axes, having separate feed mechanisms, servomotors and drivers. That means all three axes are identical as structure: feed AC servomotor, timing belt reduction, ball screw on each axis, linear Heidenhain incremental measuring scale.

In **fig. 2** is showed as sample one axis machine structure.

Except the rotary table movement, which is index table on Hirth coupling, PLC controlled.

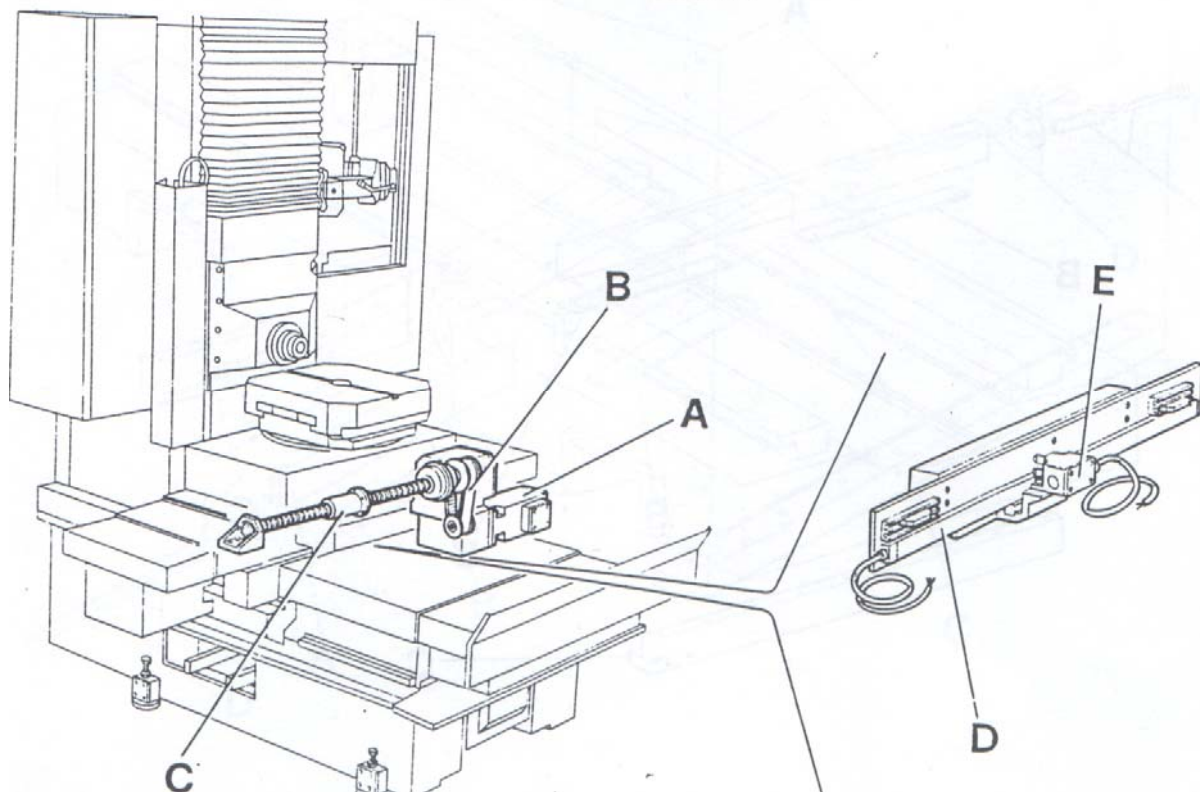


Fig. 2 – The feed mechanism and scale on linear axes

About the rotary B axis, in **fig. 3** is showed the actual Hirth coupling indexing system, and **fig.4** the correspondent hydraulic schemas.

The system is based on two hydraulic cylinders, one for the table lifting on Hirth coupling and the other one for the pallet lifting.

ABOUT THE MODIFIED SOLUTION

At the five axes machine the index table B movement must be modified to continuous rotary CNC controlled axis.

This objective needs the following changes:

- The replacement of the Hirth coupling to the large special bearing as support of the B axis (the bearing dimensions shall be in the best case the same to the Hirth's);

- The hydraulic mechanism placed in the middle of the table can remain unchanged, but it need to use in the future the lifting pallet function only, and the table lifting to be cancelled;
- To introduce in meddle of the table one rotary Heidenhain scale, or some peripheral measuring system, in order to assure the caption of the rotated table position with the requested precision of 0.001 deg.

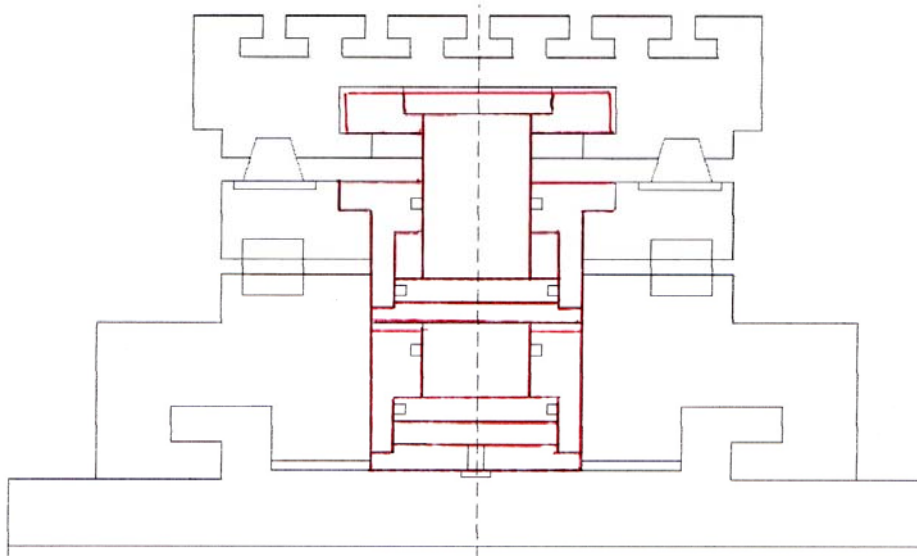


Fig. 3 – The table lifting mechanism

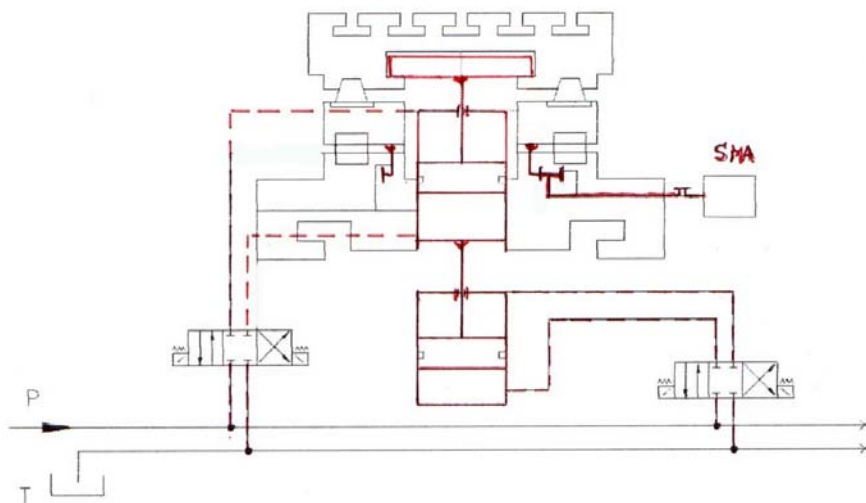


Fig. 4 – The actual hydraulic table function

On this idea, the modified hydraulic table function and the schemas with bearing instead of Hirsh coupling, is presented in **fig. 5**, as principle.

In reality, the solution will be more complicated because even the hydraulic central cylinder remain unchanged, it need at the rotary feed mechanism to solve the backlash system and the rotary preloading, and the mounting of the rotary scale.

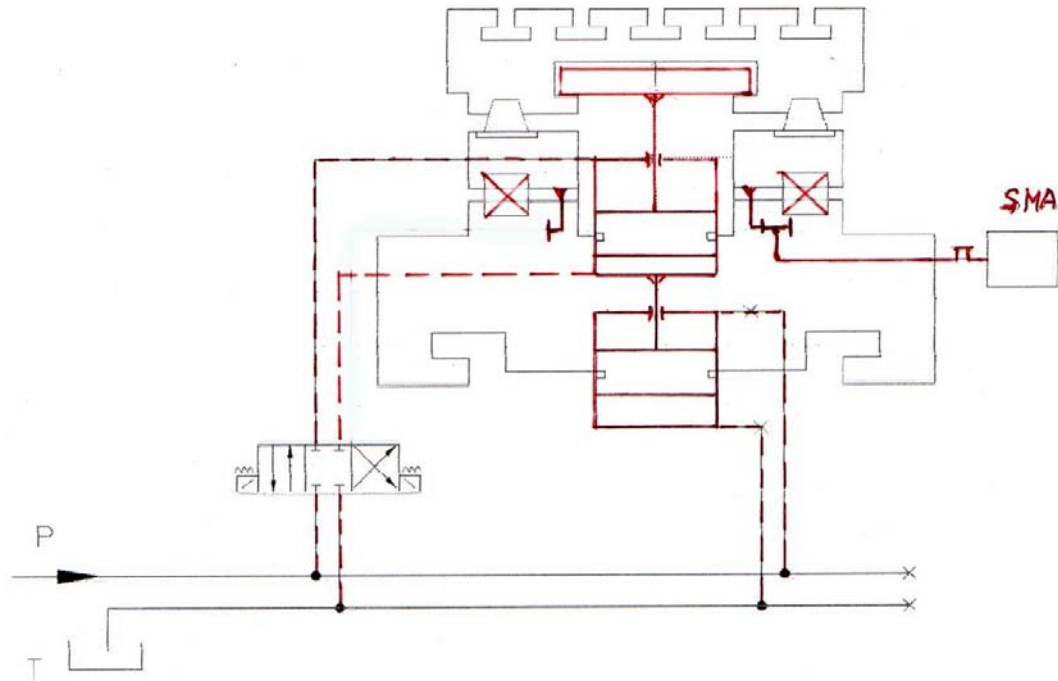


Fig. 5 – The proposed table solution

CONCLUSIONS

The five axes machining and the retrofitting activity at three and half axes machine to five axes is one very sophisticated activity, combined with design, research, science, and praxis.

Faculty of Mechanical Engineering from Oradea University will try this experience, having as objective of retrofitting into his machine tool laboratory one second hand horizontal machining centre, retrofitting activity planed for the next months.

BIBLIOGRAPHY

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